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THE GLASS-CONTAINER INDUSTRY OF WESTERN CANADA - PAST, PRESENT AND FUTURE

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled The Glass-Container Industry of Western Canada - Past, Present and Future submitted by Winston Churchill Kwawu Agbemenu in partial fulfilment of the requirements for the degree of Master of Arts

ABSTRACT

This thesis is a study of the geography of the glass-container industry of Western Canada. In examining the historical development of the industry in this region, it was found that the glass-container industry in Western Canada benefited from the technological developments which had been made by the early 'glass houses' of Eastern Canada. Following the spread of population westwards and the growth of settlements in Western Canada, the industry was established in this region. Not only the geographical changes, but also certain economic trends and the technological developments which have taken place throughout the history of the industry are revealed in the study. The analysis of the cost structure shows that the glass-container industry of Western Canada is labour-intensive. While the sources of the raw materials and the markets were close to the plants when the industry was established in the region, today the raw materials are obtained from sources which are several hundred miles away from the plants. Similarly, the markets which the industry serves are no longer confined to local breweries and food packers. It has been found that, at present, the market areas for the two plants which are in operation do not overlap. However, the market areas for the plants are expected to overlap when the third plant, which is now under construction, goes into operation. The factors which influence the choice of the site for the glass-container manufacturing plants have been found to vary in importance with respect to the different plants. It has also been found that the glass-container industry appears to be in a position to meet the challenge from containers made of other materials.

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This thesis could not have been written without the help of several people. My supervisor, Professor N. R. M. Seifried, offered invaluable suggestions and criticisms throughout all the stages of this work. He, nevertheless, allowed me to develop my own thought and approach. Professor O. F. G. Sitwell made highly critical comments and useful suggestions. I very much enjoyed working with both of them. To them I am most grateful and render my sincerest thanks. Also, I highly appreciate Mr. J. W. Sellhorn's help. As the manager of the Dominion Glass Company plant in Redcliff, he allowed me to take some of his time through correspondence, and also by granting me an interview with him. I am no less grateful to Mrs. Dean Edmundson who typed the manuscript, and to Mrs. Barbara Miller who did an excellent job with the final typing. Several other people were very helpful and I regret all the names cannot be mentioned. I am, however, very grateful to each and every one of them.

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INTRODUCTION

Since the turn of the century, the population of Western Canada has increased rapidly.[1] From 600,000 in 1900, the population grew to 5.4 million in 1966 (Population Census, Dominion Bureau of Statistics). This rapid increase in the population of the region has been accompanied by an increasing exploitation and utilization of the resources in the region.

The fur trade of the eighteenth century was replaced by the forest and agricultural products of wood, grains and meat. With the construction of the trans-continental railways, economic activities expanded, settlements developed, and manufacturing industries were established, based mainly on the processing of agricultural produce. As the industrial base became more diversified, the manufacture of other items was started, particularly products from metallic and non-metallic minerals. One of the items produced was glass and glass products.

The glass-container industry has been a part of the manufacturing activities in Western Canada for the past sixty years. Starting in Manitoba and British Columbia in 1907, it has developed into an important industry, located today in Alberta and British Columbia. It is the geography of this industry that this thesis attempts to study.

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[1] By common usage, the term 'Western Canada' refers to the part of Canada west of the Ontario-Manitoba border. This includes the four provinces of Manitoba, Saskatchewan, Alberta and British Columbia.

The geographic study of any industrial activity concerns itself with the location pattern and distribution of the industry, and the "causes and implications of that location." (Roepke, 1967, p. 415). To this end, this thesis attempts to examine, analyze, and evaluate the evolving location pattern of the glass-container industry in Western Canada, and all the factors which might have influenced its growth and distribution. Among the important locational factors which are considered to influence significantly the location of industrial activities, and which are examined in this thesis, are the raw materials used, their nature and sources, the distribution of the markets which are served, transportation facilities and freight rates, the type of fuel used and its source (Hoover, 1963, pp. 27-46; Estall and Buchanan, 1964, pp. 24-48).

The historical development of any industrial activity is an important part of manufacturing geography not only for its own sake, but also for the light it throws on the explanation of the present location pattern of the industry (Alexandersson, 1967, p. 6). For this reason, Chapter I studies the past of the glass-container industry, from its establishment in Eastern Canada until it reached the west. In addition to this, the technological progress which has been made in the history of the industry is also examined. It is felt that this is essential if the level and scale of operations are to be understood.

Chapter II describes the manufacturing process, the nature and structure of production costs, and the scale of operation at the two plants which manufacture glass containers today in Western Canada. Some of the factors which contribute to the structure of the production costs are raw materials, fuel and labour. An examination of the cost

structure, as constituted by the inputs used by the manufacturing process, also reveals the spatial distribution of these inputs. This spatial distribution is an index of the relationship between the location of the manufacturing plant and the sources of the various inputs used.

Just as there is the need to study the relationship between the sources of the inputs used and the location of the industry, so is it also necessary to examine the distribution of the finished products. This is done in Chapter III which relates the distribution of the glass containers to other elements in the region - the distribution of population and the sizes of the cities to which the glass containers are shipped.

The study of the distribution of the inputs and the finished products gives the degree of the relationship between the plants and region. But what it does not show is the extent to which each of the factors of this relationship influenced the choice of the sites for the location of the plants. An analysis and evaluation of this is done in Chapter IV to understand the role of each factor in influencing the choice of the particular sites where the glass-container manufacturing plants stand today. This is very significant because it shows how the influence of the factors of location may vary from place to place and from time to time.

The study ends with a look at the future prospect of the glass-container industry in Western Canada. This is done by examining the nature of the competition from other types of containers, and how the glass-container industry has been meeting, and plans to meet further, this challenge.

Very little has been written on the glass industry as a whole in Canada. Moreover, the scanty literature that exists deals only with

the history of the industry. To collect data for this study, the writer drew up a questionnaire, a copy of which appears at the end of the thesis. The questionnaires were followed by a visit to the Redcliff plant and an interview with the manager.

However, some difficulties were encountered during the research which posed a severe problem to the writer. Data on the glass industry as a whole in Western Canada is regarded as confidential, and no figures are published for the region in the manufacturing census reports of the Dominion Bureau of Statistics. Similarly, the companies in the industry would not easily give out information concerning the industry. It was only with the greatest difficulty that the data used in this thesis was obtained. And the secretary of the Dominion Glass Company wrote that "the. . .information [supplied to the writer] will not in any way be related to the Dominion Glass in any published material." (pers. comm.)

The writer wishes this thesis to be regarded mainly as a pioneer effort in the geographic study of the glass-container industry of Western Canada. He would be pleased to find this study carried further should data on the industry become more available.

CHAPTER I

THE HISTORICAL DEVELOPMENT OF THE GLASS-CONTAINER INDUSTRY OF CANADA

It is difficult to say precisely when glass-making, like all other manufacturing industries, started in Canada. Nevertheless, manufacturing of any kind in Canada is said to have begun not earlier than the closing decades of the eighteenth century. According to Hilda and Kelvin Spence (1966, p. 16),

> Under British rule manufacturing was at first discouraged; the colony was regarded as an exclusive market for English goods and a source of furs and lumber, and it was not until 1794 that under Jay's Treaty the colonists secured the right of reciprocal trade with the United States. Thereafter articles of glass could be imported, subject to duty, from south of the border...."

However, with the growth of population and settlements came the manufacture of some basic products. One of these was glass, the manufacture of which is believed to have been introduced into the colony by immigrants from the United States following the American War of Independence (Stevens, 1961, p. xvi). A study of the growth of the industry since then shows that three fairly distinct periods can be identified. These are: 1) the pioneer period, 2) the period of accelerated growth characterized by easy entry and exit, mergers and consolidation of firms, and 3) the present phase of industry.

The pioneer period was characterized by glass-container manufacturing activities which had a local orientation. Raw materials were completely or almost completely obtained in the surrounding areas, and the customers served were mainly local breweries and distilleries. This local outlook, particularly as regards the sale of products, would suggest that the scale of operations was small. This was the period prior to 1850.

Research done by Gerald Stevens shows that there were two glass-container manufacturing establishments in Canada during the period before 1850. One was the Mallorytown Glass Works which was located one mile west of the village of Mallorytown (Stevens, 1957, p. 4), in what was then known as Upper Canada (now Ontario). The other was the Ottawa Glass Works which was located at Como, just west of Montreal. The years during which these 'glass houses' were in operation are difficult to establish. But through his research, Stevens found that the Mallorytown Glass Works was in operation from about 1825 to 1839 or 1840, while the Ottawa Glass Works was established in 1847.

Both operations used raw materials which were abundant in the vicinity of the works, except clay which was imported by the Ottawa Glass Works.[1] For as Stevens writes (1961, pp. 12-13):

> As far as can be ascertained by digging, the first proven Canadian glass house [the Mallorytown Glass Works] used local materials. These included Potsdam sandstone, quartz, and wood-ash potash. There is no resonance to the glass, and lead was not used as a flux.

Owing to the fact that these pioneer glass houses served local markets, it is perhaps reasonable to assume that their scale of operation was small. This assumption is deduced from the fact that the settlements in which these firms were located were small communities at that time. In fact, the Mallorytown Glass Works which operated for about fifteen years is said to have been small, had one furnace, and used basic tools (Stevens, 1961, p. 15).

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[1]This detail is from a letter an informant wrote to Gerald Stevens during his research on early Canadian glass: ". . .and eight cases of clay, now in the sheds of the customs in St. Jean." (Stevens, 1961, p. 106)

> The only tools necessary. . .included a blowpipe (a hollow iron rod, usually somewhat flared at the tip), a panty rod (a solid iron rod which, applied to the base of an article being fashioned, provided a handle with which to manipulate a very hot object), a scissors (used to finish off the rims, etc.), and. . .pucellas (a U-shaped tool somewhat like sugar tongs). This last was a very important part of glass blower's equipment - he called it simply 'the tool'. (Stevens, 1963, p. 125)

With these basic tools all glass containers were produced by the 'free-blown' method. This means that moulds were not used to shape the glass containers (Stevens, 1961, p. 15). It is important to note also that the types of tools used, and the methods employed limited production to containers and whimseys.[2]

Even though the Mallorytown Glass Works and the Ottawa Glass Works were just at the pioneer stage, they made an important contribution to the economy of the districts in which they were located. Many types of artisans were required, and this offered job opportunities for the people in the area. The free-blown technique used in the production process to mould the glass containers demanded skilled glass-blowers who were in short supply at the time. The shortage was probably due to the fact that glass-blowing was perhaps the most skillful art in the whole process of glass-container manufacture. This would seem to be the reason why "the glassblowers were very highly paid for the times - five dollars a day...." (Stevens, 1961, p. 103) The skilled glass-blowers were, however, believed to have come from the United States (Hilda and Kelvin Spence, 1966, p. 16).

It can now be seen that the term 'local orientation' as applied to the Mallorytown Glass Works and the Ottawa Glass Works is quite

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[2]The word 'containers' as used here "covers many shapes and forms; included would be bottles, flasks, bowls, and pitchers. The term 'whimseys' is unlimited in scope, and could include any novelty contemporary with the dates of the factory." (Stevens, 1961, p. 15)

justified. Raw materials were obtained almost entirely within a short distance of the works; customers were located in the surrounding area and, except for the skilled craftsmen employed by the Ottawa Glass Works, all the workers were "United Empire Loyalists and their descendants" (Stevens, 1961, p. xvi).

After several years of operation, difficulties arose which led to the closure of each glass house, though in different ways. It is still not clear what factors caused the Mallorytown Glass Works and the Ottawa Glass Works to go out of business. Yet it has been revealed in the scanty records available that the Mallorytown Glass Works was closed because the foreman was unreliable (Stevens, 1961, p. 12), while the latter "was short-lived because of the overwhelming competition from American glass manufacturers." (Dominion Glass Company, 1963). The fact that the Mallorytown Glass Works was closed because the foreman was unreliable underscores the scarcity of skilled labour, as has already been indicated. That competition from American producers forced the closure of the Ottawa Glass Works would suggest that imports were perhaps unrestricted, and also that infant industries were not sufficiently protected by tariffs. These appear to be some of the factors which prevented the two pioneer glass houses from continued production.

After the closure of the two glass houses, there was a short-lived period when the industry was not in existence in Canada. Starting with the Foster Brothers Glass Works in St. Johns in 1855, a new era in the history of the Canadian glass-container industry had begun and lasted till about 1912. Not only did population and settlements in Eastern Canada grow fast at this time, but they were accompanied by

an economic boom which led to a significant development in transportation and business expansion. In the words of Hilda and Kelvin Spence (1966, p. 17),

> As the century progressed and the colony developed in population, transportation and self-reliance, business expanded beyond the local suppliers into partnerships and companies serving a larger field, and in Lower Canada the first organized production of glass for the Canadian market had its beginnings.

The generally buoyant economic situation provided an environment in which numerous scattered plants were established. However, many of these plants operated for only short periods of time and closed down because of financial difficulties (Dominion Glass Company, 1963). Thus even though the general business conditions were much better than had hitherto been the case, not all the glass-container manufacturing activities were to survive. This was a period of technological evolution and transition when it was as easy for a company to 'fall out' as it was to enter the industry. This is reflected in Fig. 1 which shows the number of companies operating, and the number of those closing down, every year throughout the entire period.

That this was a period of easy entry and exit can be seen from the fact that within a quarter of a century (1855 - 1880), nine glass-container manufacturing companies were in operation. The twelve-year period ending in 1892 saw eight other companies established, and within twenty years, from 1893 to 1912, there were another eight established (see Appendix). Thus from 1855 to 1912 there had been 25 glass-container manufacturing companies in operation for varying lengths of time. But by the turn of the century, only nine of these glass factories were still in operation; and of these nine, only four remained in production in 1912.

NUMBER OF PLANTS OPERATING OR CLOSED DOWN EACH YEAR FROM 1855 TO 1912

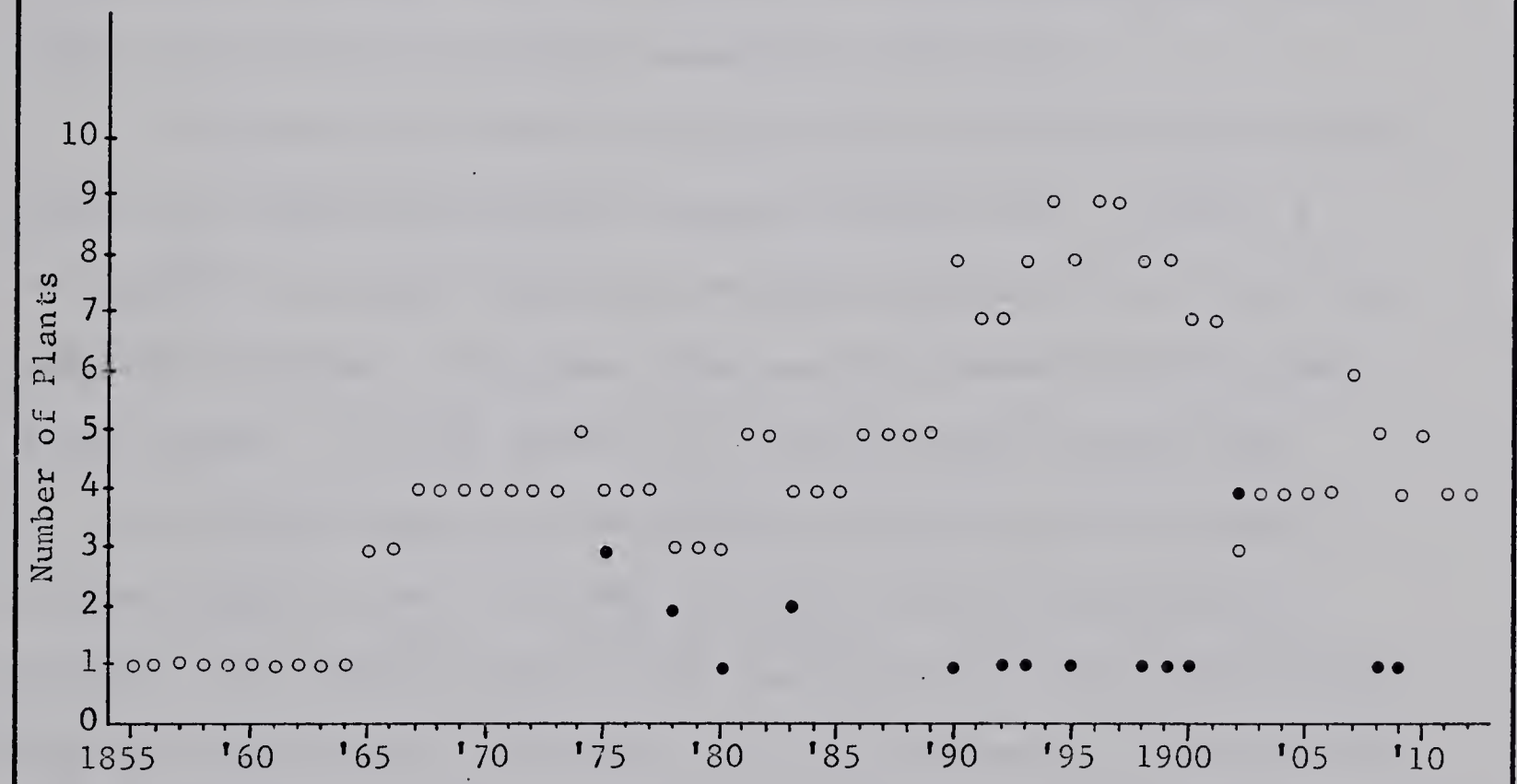

Figure 1

The ease of entry and exit was not the only feature of the period. More important was the fact that there was a marked development in technology and the nature of operations. Hand operations gave way gradually to machine production. According to Stevens (1963, p. 145), at the Canada Glass Works Company Limited, for instance, ". . .a steam engine [had] been erected to drive all the machinery, which includes a Crushing mill. . . ." This increasing use of machinery led to an expansion in the scale of operations. Also, there was one significant trend during the period which Fig. 1 does not reveal. It does not show that some factories had changed names and management several times, and were listed each time as though they were newly established. The story of the Foster Brothers Glass Works, which was established in 1855, exemplifies this point.

It appears that after having been in operation for about twenty years, the company experienced financial difficulties. In 1875, a new company was formed which took over the management of the firm from the Foster Brothers. The glass works was then renamed the St. Johns Glass Company. In 1878, however, the Yuile Brothers acquired the St. Johns Glass Company and renamed it The Excelsoir Glass Company (Stevens, 1967, p. 44). In 1880, the whole factory was moved to Montreal. The move was said to have been effected because the factory was "not close enough to customers and other business in the metropolis, and difficulties in being able to make satisfactory tax arrangements. . . ." (Stevens, 1967, p. 44) This would suggest that the scale of production had increased, and customers were no longer only local, but also quite far away. Also, it would indicate that as industry expanded, taxation probably increased. In 1883, the whole plant was moved again, but

this time to another part of Montreal and the name was changed to The North American Glass Works. The factory remained at this location and continued the manufacture of glass containers until 1912, changing its name twice in the meanwhile. In 1891, it became the Diamond Glass Company Limited and then in 1902 The Diamond Flint Glass Company Limited. The changes in the names and management were due to what may, perhaps, be termed a wave of consolidation. While the period 1855-1912 was one of easy entry and exit characterized by many scattered plants, it was also, in a sense, a period of mergers and consolidation. Since the industry was developing fast and passing through a technological transition, the entrepreneurs perhaps realized that greater economies of scale could be achieved by operating on a fairly large scale. This was probably what led to mergers, and accounted also for some companies absorbing other plants as did the Diamond Glass Company Limited.

> The Diamond Glass Company which came into existence in 1891, set out on a programme of expansion which absorbed several successful operations in other areas. In 1893, along with two small glass factories in Nova Scotia, they purchased the Hamilton Glass Works, Hamilton, Ont., operating since 1865, and the Burlington Glass Works, also in Hamilton, established in 1875. Both these companies were producing all types of glassware, both blown and pressed, with production relying solely on manual operation. (Dominion Glass Company, 1963)

This wave of consolidation did not, however, cover the entire period of 1855-1912. Having absorbed a number of smaller glass factories, the Diamond Glass Company Limited was then set on the road to becoming a big company, and a leader in the industry. The technological progess of the period also worked in their favour. It could perhaps be said that the general economic conditions of the period more or less adopted them. Operating now on a wider base, the company grew

rapidly, and before the end of the first decade of the twentieth century purchased the Toronto Glass Works, took over the assets of the Syndenham Glass Company in Wallaceburg, Ontario, in 1913 (Dominion Glass Company, 1963).

It must be remembered at this point that only four glass-container factories were in operation in 1912. These were the Syndenham Glass Company in Wallaceburg, the Diamond Flint Glass Company in Montreal, the Humphreys Glass Works in Trenton, Nova Scotia, and the Manitoba Glass Manufacturing Company in Beauséjour, Manitoba. It can be seen therefore that by the end of this second period, a high degree of industrial concentration had begun. The large number of small scattered factories which characterized the early stages of the period had disappeared gradually as a result of mergers and absorption of smaller firms by more successful ones. One of the large companies which emerged was the Diamond Flint Glass Company Limited, which further expanded its activities. In 1906 this firm built the Canadian Glass Company plant in Montreal. This new plant was equipped entirely with automatic bottle-making machines. In 1913, another factory was built in Redcliff, Alberta, to use the plentiful supply of natural gas available in that area (Dominion Glass Company, 1963).

The year 1913 is known for a feature more important in the history of the Canadian glass-container industry than has so far been pointed out. It was the year in which the present organizational phase of the industry started. This phase started with the formation of the Dominion Glass Company Limited. This new firm incorporated the Diamond Flint Company's factories in Montreal, Toronto, Hamilton and Redcliff, its subsidiaries the Canadian Glass firm in Montreal, the

Syndenham plant in Wallaceburg, the Manitoba Glass Company, and the majority stock of the Jefferson Glass Company in Toronto (Dominion Glass Company, 1963). It was also in the same year that a group of people who had gained experience from the Diamond Flint Glass Company established a new firm, the Atlas Glass Company Limited (Stevens, 1967, p. 54). This new company had financial difficulties and was replaced by the Premier Glass Company only to be replaced also by a company which had gained better financial support. This was the Consumers Glass Company which, incorporated on October 4, 1917, completed the factory which had been started by the Atlas Glass Company, and went into operation. Thus it was that the year 1913 marked the beginnings of the two companies - the Dominion Glass Company Limited and the Consumers Glass Company Limited - which, today, are the only companies in the glass-container industry in Canada.

A very large percentage of the glass containers used in Canada today come from eight manufacturing plants. Three of these plants are owned by the Consumers Glass Company, and five by the Dominion Glass Company. Of the eight plants, two are located in Western Canada, and they are both branch plants of the Dominion Glass Company. (However, a new plant is under construction, also in Western Canada, by the Consumers Glass Company.) The two Dominion Glass Company's plants are located in Redcliff, Alberta, and Burnaby in British Columbia. The former was built in 1913 and the latter in 1964-65.

Before the Dominion Glass Company's branch plants were built in Western Canada, some other companies had established glass-container manufacturing operations in the region. These pioneer glass houses in Western Canada were located in Manitoba and British Columbia. However,

as in Eastern Canada, these earliest factories did not operate for a long time. Like the early factories in Eastern Canada, they experienced financial difficulties, and some were also plagued by the adverse effects of World War I. For instance, European raw materials sources were cut off. It is interesting to note that, as in Eastern Canada, none of the pioneer factories in Western Canada still operates today. In fact, of the three provinces,* Alberta was the last to enter the glass-container industry. Yet, for over forty years, she supplied a large percentage of the glass containers used in bottling products manufactured in Western Canada.

The earliest glass houses in Western Canada mentioned above did not start until after the turn of the century - more than eighty years after the country's first glass house was established in Mallorytown. This was in 1907 when the Crystal Glass Company and the Manitoba Glass Manufacturing Company Limited started operations in New Westminster, British Columbia, and Beauséjour in Manitoba, respectively.

The Crystal Glass Works which started production in July, 1907, was scheduled to use silica sand along the Fraser river which was tested and found suitable for manufacturing glass (The Daily Columbian, April 28, 1906). Another report in the same newspaper shows that when the factory started production it was using imported raw materials, the silica sand coming from Belgium and soda ash from England (The Daily Columbian, July 26, 1907). The domestic silica sand was not used because it was in quartz form and could be used only after it was crushed.

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*The three provinces are Manitoba, Alberta and British Columbia. Saskatchewan has never had a glass-container manufacturing industry.

However, the company had planned to "secure its supply in the provinces as soon as the necessary plant can be installed for crushing it...." (The Daily Columbian, August 19, 1907). In the case of raw materials, therefore, the Crystal Glass Works, unlike the pioneer glass factories in Eastern Canada, depended on overseas sources rather than local supplies. However, not all the inputs came from overseas. For instance, the fuel used for the large amount of heat needed to melt the raw materials was gas manufactured from coal. This was done locally in a plant which was built close to the factory (The Daily Columbian, July 26, 1907).

Nevertheless, there were some areas of the industry in which the factory drew on the resources of Eastern Canada's glass-container industry. Skilled labour was supplied by people who had worked in glass houses in the east. Of a total number of sixty people who were employed at the start of the operation, twenty-five were skilled glassblowers who had worked in the east (The Daily Columbian, August 19, 1907). Starting production in 1907, the Crystal Glass Works reaped the fruits of the technological progress which had already been made in the industry. Equipped with the latest machines of the times, and with skilled workmen who ran the process smoothly on a shift basis, the Crystal Glass Works turned out "anywhere from eight to ten thousand pieces of glass every twenty-four hours," (The Daily Columbian, August 19, 1907) constituting six to eight tons of glass goods per day. The products manufactured included insulators, fruit jars and wide mouthed jars for various food-packing industries (The Daily Columbian, July 6, 1907). Although there is no record regarding the amount of each item turned out, it seems quite certain that the bulk of the products turned out were jars. One is led to this conclusion because

The Daily Columbian reported that 3,500 jars were produced in nine hours (August 19, 1907).

The products which the Crystal Glass Works turned out found ready markets within a radius of about 20 miles. This market had already been established by imports from the east and the United States (The Daily Columbian, August 19, 1907). The biggest customers were various fruit canning industries, the New Westminster Distillery and the Vancouver breweries. The proximity of the markets turned out to be one of the greatest advantages the factory enjoyed. This constituted a "great saving to them in transportation and breakage as a large percentage of the bottles shipped from the east or from the continent arrived. . .in fragments" (The Daily Columbian, August 19, 1907).

Promising as the operations of the Crystal Glass Works were, the firm appeared to be very short-lived. There does not seem to be any record as to why it closed down in 1908. From this time until 1913-14, therefore, there was no glass-manufacturing industry in British Columbia.

Meanwhile, in 1907, another glass factory had started operations in Manitoba. This was the Manitoba Glass Manufacturing Company Limited, located at Beausejour. Although this factory is said to have operated for seven years, it is surprising that there appears to be less information about it than there is about the Crystal Glass Works which lasted for only one year.

By all indications, it seems operations progressed steadily and satisfactorily until the factory caught the attention of the Dominion Glass Company Limited. This company had by then emerged as the successor to the Diamond Flint Glass Company Limited as has already

been noted. It is not known when the Dominion Glass Company acquired the properties of the Manitoba Glass Manufacturing Company. However, as a magazine publication states,

> The main industries of the town are brickworks, sand and gravel pits and the glass works. The Dominion Glass Co. are the owners of the glass works and in addition to the two factories they own here have factories also in Montreal, Wallaceburg and Redcliff. (Selkirk et al., 1913, p. 51)

It has already been noted that the years 1913-14 marked an important landmark in the history of the glass-container manufacturing industry in Canada. They were perhaps of even greater importance in Western Canada. For one reason, that was the only time when as many as three glass factories were in operation in the region. Two of these were in Manitoba and the third was in Alberta. In addition, another factory was under construction in Victoria, British Columbia. The three factories which were in production during the period 1913-14 were those mentioned in the magazine article quoted above. Of particular importance is the fact that these three plants were owned by the Dominion Glass Company. But it is not clear why the company closed down the Manitoba Glass Manufacturing Company in 1914, just a year after they had built a new plant, also located in Beausejour.

At the same time, plans were being made in Victoria for the establishment of the Victoria Glass and Bottle Co. Ltd. Financed by outside capital and outside shareholders, the company was incorporated in July, 1914. A detailed study had been done concerning the feasibility of the venture, and published in the company's prospectus. But the company never started production, and nothing more is known about it. However, W.E. Ireland feels the Victoria Glass and Bottle Company was a

World War I casualty (pers. comm).*

Thus, in 1915, only two glass factories were in production in Western Canada. These were the Dominion Glass Company's plants built in 1913 in Beausejour and Redcliff. The two operated until 1918 when "it was found glass could [be] made in Alberta with natural gas more economically. . . ." (Beausejour, 50th Jubilee, 1912-1962). The factory in Manitoba was therefore closed about 1918 and the workers and the equipment were moved to Redcliff (Stevens, 1967, p. 72). From this time, therefore, the Dominion Glass Company's plant in Redcliff was the only survivor to serve Western Canada. This it did for over forty years until the company built a branch plant in Burnaby, British Columbia, in 1965. Since then, the Burnaby plant has taken over a large portion of the British Columbia market from the Redcliff plant. The Redcliff plant has, as a result, concentrated on the Saskatchewan and Alberta markets. The Manitoba market is served by Consumers and Dominion Glass Companies' plants in Ontario.

The glass container industry of Western Canada, as it is known today, is then, to a large extent, the story of the Dominion Glass Company's achievements in the region to date. These achievements have been made possible by their two plants in Redcliff and Burnaby. It is the geography of these two plants that we shall now attempt to study.

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*W. E. Ireland is the provincial librarian and archivist in British Columbia.

CHAPTER II

THE MANUFACTURING PROCESS, AND THE NATURE AND STRUCTURE OF PRODUCTION COSTS

All manufacturing industries process a supply of raw materials. These raw materials and all the other inputs which most industries use are not obtainable at equal cost, nor from one source since they are unevenly distributed on the face of the earth (Estall and Buchanan, 1964, p. 24). Some of the important inputs, apart from the raw materials, are fuel and labour resources. Each of these inputs is an important element in the composition of the production costs (Roepke, 1967, p. 415). Their geographic distribution and the costs of assembling them at the factory usually play an important role in the location of the industry (Estall and Buchanan, 1964, p. 24). The location then reflects the spatial relationship between the factory and the sources of these inputs.

The examination of the structure of production costs is an important aspect of manufacturing geography. This is because such an examination shows the importance, in terms of cost, of the various inputs, and to what extent the source of each might have influenced the location of the industry. It is necessary, at this point, to analyze the extent to which these characteristics are reflected by the glass-container industry of Western Canada.

Of all the inputs which the glass-container manufacturing industry in Western Canada uses, raw materials are the most widely distributed. The principal raw materials used are silica sand, soda ash, limestone, and nepheline syenite. Among the others are saltcake and sodium nitrate, though they are used in rather insignificant quantities. In addition to these, "broken, or scrap glass, known as

'cullet'," is also used (Alderfer and Michl, 1957, p. 218). Before analyzing the effects which the spatial distribution of the inputs has on the structure of production costs, a brief description of the manufacturing process may be useful.

To manufacture any type of glass, the raw materials mentioned above are mixed in a section of the factory called the 'batching plant'. The proportions of the various raw materials mixed are governed by the quality desired in the finished product. From the batching plant, the mixture is

> conveyed into the furnaces. The furnaces, which are heated to approximately 2,800°F, melt the raw materials to form molten glass, with a resultant 17% [sic] reduction in weight in the process. The molten glass is fed out through feeder lines, which produce "gobs" at the end. The "gobs" drop into the moulds in the bottle machines, air is forced in which blows the gobs of glass to the form of the moulds, the moulds open up - and formed bottles appear. The bottles move down conveyor lines and are cooled and annealed. Then they are inspected. (Pitfield, et al, 1967, p. 5)

With the foregoing description in mind, let us examine the nature and structure of the industry.

Table I gives the quantities of the raw materials which each of the two plants used in 1968. It is clear from the table that silica

TABLE I - QUANTITIES OF RAW MATERIALS USED BY EACH PLANT IN 1968
(Figures in tons)

RAW MATERIALS	REDCLIFF PLANT	BURNABY PLANT
Silica Sand	42,360	15,600
Soda Ash	14,499	4,600
Limestone	12,200	4,400
Nepheline Syenite	4,595	1,560
Miscellaneous*	18,750	119.5
TOTAL	92,404	26,279.5

*The term 'miscellaneous' as used here includes all the less important raw materials, such as saltcake, sodium nitrate, cullet, etc.

sand is the most important raw material used, constituting about one-half of the total weight of the batch mixture. The order of importance of the other raw materials is clear from the table. However, 'miscellaneous' raw materials were the second most important at the Redcliff plant. According to an industry spokesman, this was due to the fact that a large amount of these 'miscellaneous' raw materials was cullet, which, strictly speaking, is not a raw material (pers. comm.). It is, nevertheless, advantageous to use because it shortens the melting time of the whole mixture, and thus reduces fuel and raw material costs (Alderfer and Michl, 1957, p. 220). With these quantities, the Redcliff and the Burnaby plants manufactured 75,000 tons and 21,000 tons respectively of glass containers.

There is an important aspect of the raw materials which should be kept in mind. As pointed out in the quotation above, the raw materials lose weight during the melting process. A comparison of the production figures and the quantities of the raw materials used shows that the loss in weight of raw materials incurred was 18.9 and 20.9 per cent at the Redcliff and Burnaby plants respectively. These percentages are very close to the 17 per cent which Pitfield et al give as the average for all the glass-container manufacturing industries in Canada.

More important than the amount of raw materials lost, however, is the scale of operation which the production figures indicate. To bring the level of production in 1968 out clearly, it is necessary to compare the production figures for that year with the levels at which maximum economies of scale could be achieved. The production figures which would represent these levels are by no means the same for both plants. For, according to Griffiths, these levels depend "on a wide variety of

variables, such as size of market, average run size of items, cost of fuel at any location, cost of materials at any location etc." (pers. comm.)[1] This perhaps explains why the Redcliff plant would achieve the maximum economies of scale if it produced between 40,000 and 65,000 tons of glass containers per year. However, the Burnaby plant would achieve maximum economies of scale if it produced 73,000 tons of glass containers per year. This shows that the scale of operations at the Redcliff plant in 1968 was above the level which would have given the lowest unit costs of production. The Burnaby plant, on the other hand, manufactured only 21,000 tons of glass containers in 1968. The 73,000 tons which is said to give the plant the maximum economies of scale is merely a projection for the future, and may not be attained for some time.

Compared with the capacities of the plants, however, the production figures above present a different picture. While the Redcliff plant has an annual capacity of 87,000 tons, the Burnaby plant's capacity is 34,800 tons (Pitfield et al, 1967, p. 6). With production figures of 75,000 and 21,000 tons, the Redcliff plant utilized 86.2 per cent of its capacity while the Burnaby plant utilized only 60.3 per cent of her capacity. This relatively low percentage which the Burnaby plant utilized of its capacity is due to the fact that the plant's operations are still at a fairly young stage.

As has already been pointed out, the sources of the inputs used are widely distributed. An examination of the sources of the raw

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[1] A. F. Griffiths is the Executive Vice-President of the Consumers Glass Company Limited.

materials reveals that the two plants look outside the provinces in which they are located. Figures 2 and 3 show that of the four principal raw materials, only limestone is supplied from within the province in which each plant is located. The Redcliff plant receives its supply from Crowsnest Pass in Alberta, and the Burnaby plant from Texada Island in British Columbia. If it is realized that limestone was only 13.2 and 16.7 per cent of the raw materials used by the Redcliff and Burnaby plants respectively in 1968, then it can be seen that, in terms of the quantity of raw materials, the industry is not strongly tied to the provinces.

Figures 2 and 3 show the spatial relationship between the sources of the raw materials and the location of each factory. As can be seen from the maps, soda ash comes entirely from Wyoming in the United States. Only 36.5 per cent of the silica sand used by the two factories comes from Canada, the source being Selkirk in Manitoba. Another 36.5 per cent is imported from Minnesota. These percentages represent the 42,360 tons which the Redcliff plant used in 1968. The remaining 27 per cent of the silica sand imported to Western Canada comes from Washington, and this constitutes the entire 15,600 tons used by the Burnaby plant in 1968. The only raw material which both plants buy from the same source in Canada is nepheline syenite. This mineral comes from Nephton in Ontario. Furthermore, it can be deduced from the flowlines that the Redcliff and Burnaby plants look towards the United States for about 38.5 and 73.8 per cent respectively of their raw materials. While Redcliff depends on Canadian provinces other than Alberta for 27.8 per cent of its raw materials, Burnaby imports only 4.3 per cent of its raw materials from Ontario. Taken together, all this shows that the Burnaby plant is oriented towards foreign sources

RAW MATERIALS FOR BURNABY PLANT

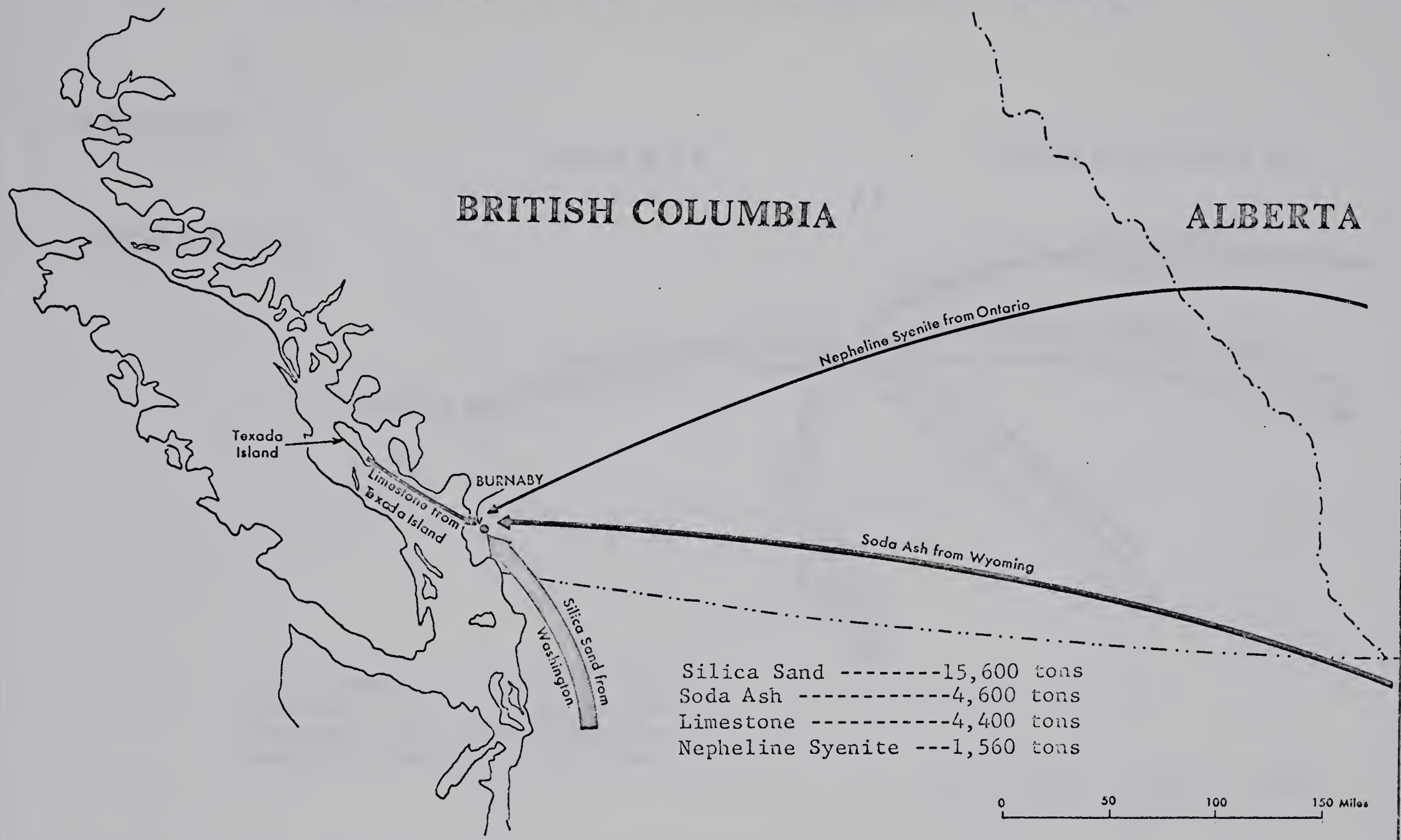
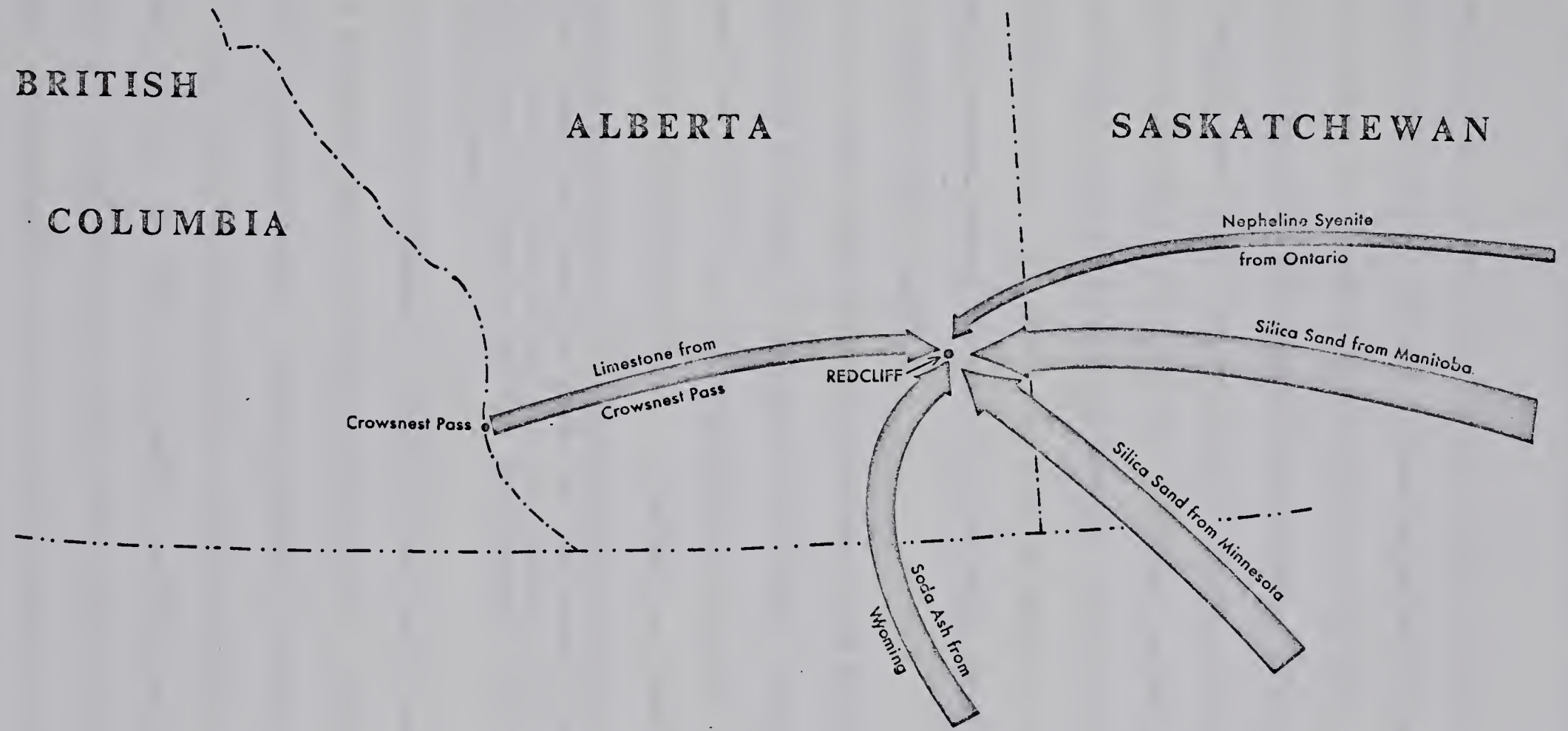


Figure 3

RAW MATERIALS FOR REDCLIFF PLANT



Silica Sand ----------42,360 tons
Soda Ash ------------14,499 tons
Limestone -----------12,200 tons
Nepheline Syenite ---- 4,595 tons

Figure 2

for its raw materials to a much higher degree than the plant in Redcliff is.

What Fig. 2 does not show, however, is the fact that there have been changes in the sources of silica sand supplied to Redcliff. Before the current sources in Manitoba and Minnesota were used, the sources of supply were located in Washington and Illinois. The changes in the sources of supply have been due not so much to the quality of the raw materials from the current sources, but more particularly to the price factor. According to the industry spokesman, the raw materials obtained from the current sources are about the same in quality as those from the previous supply areas; nevertheless, they are much cheaper than those previously obtained (pers. comm.).

Why the silica sand deposits in Alberta and British Columbia are not being used by these factories is not clear. Large deposits of silica sand suitable for glass manufacture are said to exist along the Peace River in Northern Alberta. According to Crockford (1949),

> A glass sand occurs in the uppermost 40 to 60 feet of the Peace River formation along the banks of the Peace River. . .about 60 per cent is glass sand. . . The amount of available glass sand appears enough to attract development, for it may exceed 1,000,000 tons.

However, the industry spokesman in Redcliff maintains that these silica sand deposits have too high an iron content, and are not suitable for glass manufacture. Also, deposits are known to exist around Fort McMurray, Fort Saskatchewan and Mt. Eisenhower, though these have not been tested. In British Columbia, on the other hand, there is no indication as to why the Fraser river sand which the Crystal Glass Works of 1907 was expected to use is not being used at present. It may, however, be due to the fact that the Burnaby plant is still at its initial stage, and has not yet developed enough to justify the erection of equipment and machinery to crush the sand since it is in

quartz form.

As Figures 2 and 3 clearly show, some of the raw materials sources, for instance, Nephton in Ontario, which supplies nepheline syenite, are so far away from the plants that freight costs form a substantial portion of the cost of the raw materials. To illustrate this point, the freight rates which the Redcliff plant pays for each ton of raw material brought in to the plant are given below:

Silica Sand (from Manitoba)	$ 6.46
(from Minnesota)	$16.66
Soda Ash (from Wyoming)	$21.15
Limestone (from Alberta)	$ 4.30
Nepheline Syenite (from Ontario)	$26.67

According to the answers received by means of survey questionnaires, the cost of, and the freight rates on, the raw materials add up to 25 per cent and 27 per cent of the total production costs at the Redcliff and Burnaby plants respectively.

Having examined the raw materials aspect of the linkage of the industry, let us look at the situation with regards to the other inputs. These inputs are fuel and labour costs.

To manufacture glass, heat is required in large quantities and at the very high temperatures of between 2,500°F and 3,000°F (Alderfer and Michl, 1957, p. 217). These high temperatures must be generated at the least possible cost. For the exacting demands of the glass industry, natural gas is said to be an ideal fuel (Alderfer and Michl, 1957, p. 220). The importance and suitability of natural gas to the glass industry as a whole has already been stated when it was noted that this fuel was used as far back as 1918. It was said that the Manitoba Glass Manufacturing Company was closed down and the men and equipment were moved to Redcliff because it was found that glass

could be made more cheaply in Alberta with natural gas. Since then, fuel sources have become one of the important locational factors of the industry. On the average, fuel and electricity costs form four per cent of the total production costs of all the glass-container manufacturers in Canada (Pitfield et al, 1967, p. 5).

At this stage, it is necessary to point out that the expenditure on fuel and electricity at the Burnaby plant adds up, on the average, to just under seven per cent of total manufacturing costs. But the Redcliff plant reports that fuel costs are "practically nil." (pers. comm.). The difference in fuel costs between the two plants, then, is rather large. However, the reason for this situation is not hard to find. Interviewing the industry spokesman, the writer found that while the plant in Burnaby buys its fuel and electricity supplies from British Columbia Hydro, the Redcliff plant has and uses its own natural gas reserves. This, however, does not mean that no fuel costs are incurred. What it involves is only the fact that the Dominion Glass Company does not pay any other company directly for fuel supplies, and so considers, rather misleadingly, that fuel costs are practically nil. It should therefore be pointed out that this is the accounting method used at the plant.

One factor which is fundamental to all manufacturing activities is a supply of labour. The importance of the composition of the work force and the role it plays in the cost structure of an industry cannot be over-emphasized. This is no less true of the glass-container industry than of any other. From the description of the manufacturing process above, it is obvious that a high degree of automation is used up to the point of inspection. But the nature of the glass-container manufacturing process is such that a large pool of labour is employed despite the high

level of technology and the increasing use of automation. According to Pitfield et al, (1967, p. 5), about half the number of people employed at the glass-container manufacturing plants are engaged in inspection and packing. Although a fairly large number of people are employed, there is not as great a demand for skilled labour today as there was prior to the turn of the century when the containers were moulded entirely by manual operations. This fact is underscored by Table II which shows the composition of the labour pool on the basis of skill. Of the total number of 600 people employed at the Redcliff plant

TABLE II - NUMBER OF EMPLOYEES AND THE COMPOSITION OF THE LABOUR POOL AT THE REDCLIFF AND BURNABY PLANTS IN 1968

PLANT	TOTAL NO. EMPLOYED	SKILLED		SEMI-SKILLED		UNSKILLED	
		NO.	% OF TOTAL	NO.	% OF TOTAL	NO.	% OF TOTAL
Redcliff	600	90	15	150	25	360	60
Burnaby	200	60	30	120	60	20	10

in 1968, only 90 (or 15 per cent) were regarded as skilled, while the corresponding figures for the same year in Burnaby are 60 (or 30 per cent) of the total employed. The greatest discrepancies appear in the semi-skilled and unskilled categories. While Redcliff reports 150 (or 25 per cent) of the total employed as semi-skilled, Burnaby lists 120 (or 60 per cent) under the same category. Similarly, while over half of the employees in the Redcliff factory (360 or 60 per cent) are regarded as unskilled, only 20 (or 10 per cent) is so reported from the Burnaby plant. Analyzing the answers given in the questionnaires, the writer found that the wide disparity in the

composition of labour may be attributed to the terms "skilled", "semi-skilled", and "unskilled" which are vague, and mean different things to different people. Nevertheless, there is one interesting phenomenon to note. The total number of workers employed at the Burnaby plant is 33.3 per cent of the total of 600 employed by the Redcliff factory. A comparison of the relationship between the total number of people employed and the production figures raises a question. Why was the output from the Burnaby plant less than one-third (28 per cent) of the output of the Redcliff plant although the former has more modern facilities and a full one-third the total number of employees at the latter plant? The probable answer may be that labour productivity at the Burnaby plant is well below its potential level because the plant is just developing.

However, the mere number of people employed does not give an index of the proportion which labour costs form of total production costs. This proportion is revealed, inter alia, by the amount of money paid to the workers in wages, the structure of which is shown by Table III.

TABLE III - THE STRUCTURE OF WAGE RATES - 1968

PLANT	LOWEST HOURLY WAGE	HIGHEST HOURLY WAGE	AVERAGE HOURLY WAGE	LABOUR COSTS: % OF TOTAL PRODUCTION COSTS
Redcliff	$2.16	$2.87	$2.57	44.51
Burnaby	$2.55	$3.41	$2.85	37.70

A comparison shows that wages are, on the average, 15.9 per cent higher at the Burnaby plant than at the Redcliff plant. The disparity may be attributed to the fact that British Columbia is a higher-wage

province than Alberta is. Also, labour unions in British Columbia are considered more militant, and make more wage demands. According to McGovern (1961), "High labor costs and poor labor-management relations are a feature of British Columbia. . . ." On the contrary, labour-management relations in Alberta are said to be very cordial.

> The record of industrial peace in Alberta is an indication of the soundness of the Alberta Labour Act and its acceptance by employers, employees and the public in general. According to the Federal Department of Labour, over a period of many years the number of man days lost through work stoppages in relation to industrial working time is lower than for any other province: it is less than one-half of one per cent. (Alberta: Industry and Resources, 1964, p. 183)

There is an important feature of wages which Table III does not show. This is the rate at which wages have increased during the past few years. That wages are higher in Burnaby is demonstrated by the percentage increase during the short time that the plant has been in operation. From 1966 to 1968 inclusive, average hourly wage rates increased at the annual rate of 6.6 per cent, or from $2.35 to $2.85. At the Redcliff plant, wages have also increased, though at a slightly lower rate. Over a ten-year period ending 1968, the average hourly wage increased from $1.49 to $2.57. This gives an annual increase rate of 6.0 per cent, 0.6 per cent less than at the Burnaby plant. But how far have these increases affected the proportion which labour costs form of total production costs?

As shown by Table IV and Fig. 4a, labour costs formed, on the average, 44.5 per cent of the total production costs at the Redcliff plant during the nine-year period ending 1968. Clearly, Table IV shows the variations in both the number of people employed and labour's share of total production costs during the period in question. Regression

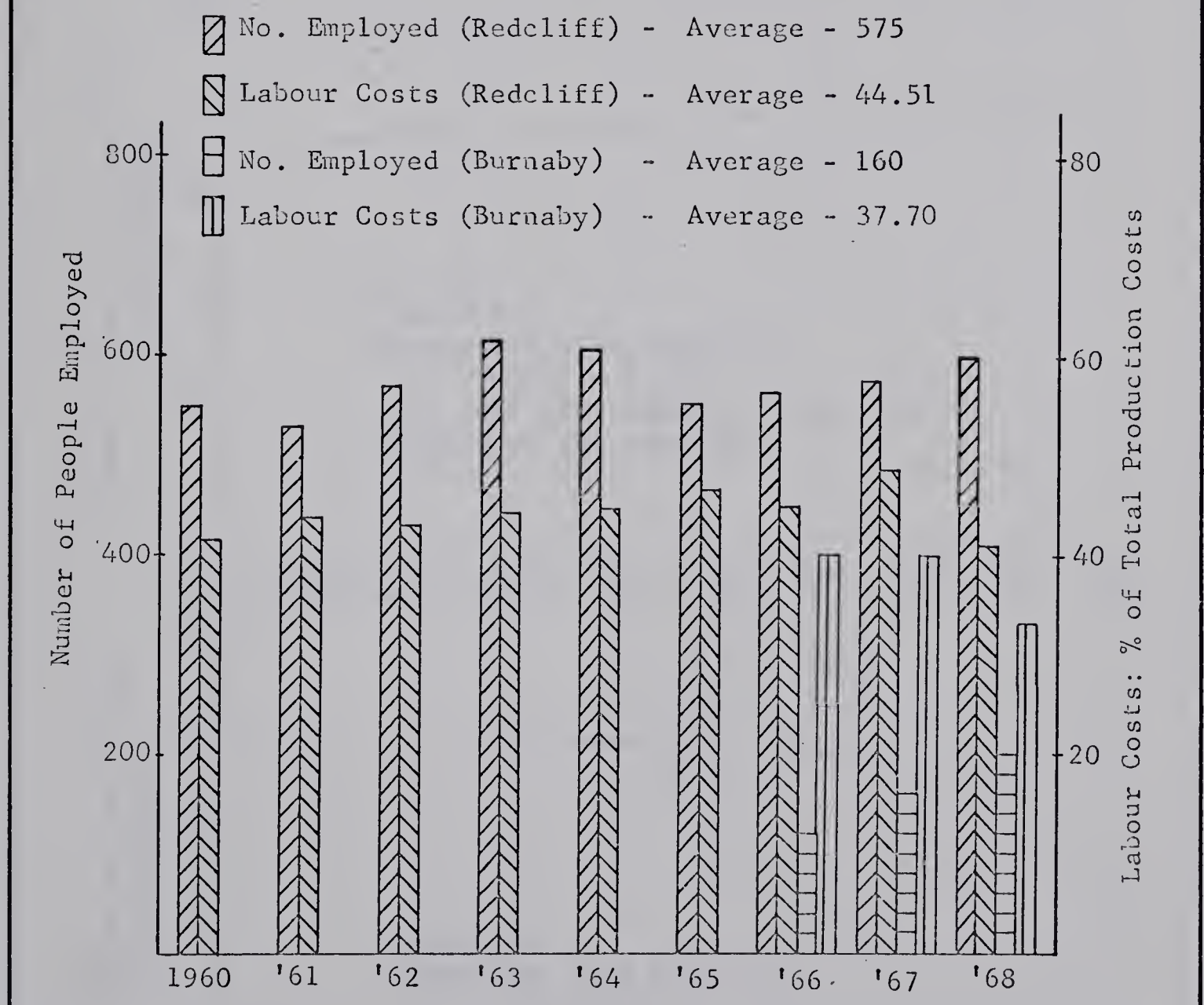
TABLE IV - NUMBER OF EMPLOYEES, AND LABOUR'S SHARE OF TOTAL PRODUCTION COSTS AT THE REDCLIFF AND BURNABY PLANTS: 1960 - 68

YEAR	REDCLIFF PLANT		BURNABY PLANT	
	NUMBER EMPLOYED	LABOUR COSTS: % OF TOTAL PRODUCTION COSTS	NUMBER EMPLOYED	LABOUR COSTS: % OF TOTAL PRODUCTION COSTS
1960	555	41.92	-	-
1961	533	43.99	-	-
1962	565	43.07	-	-
1963	617	44.25	-	-
1964	607	44.72	-	-
1965	556	46.87	-	-
1966	563	45.66	120	40.00
1967	577	48.72	160	40.00
1968	600	41.36	200	33.00
AVERAGE	575	44.51	160	37.70

analysis of the data in the table shows that there tended to be a slight increase every year in the number of people employed (Fig. 4b).[2] Similarly, a slight increase was observed in labour's share of total production costs (Fig. 4c). It should be pointed out that the regression line in Fig. 4b rises a little faster than the regression line in Fig. 4c. When the data for the number of people employed and the percentage of total production costs attributable to labour were correlated, it was found that the variations in labour costs are not explained to any great extent by the

[2]The regression and correlation analysis referred to in this paragraph was carried out on the University of Alberta's IBM 360/70, using an APL remote terminal. The programme used was that described in K. W. Smillie, Statpack 1: An APL Statistical Package, Publications of the Department of Computing Science, University of Alberta, No. 9, Edmonton, p. 29. The regression equations and the coefficient of correlation computed by the programme will be found in Figures 4b, 4c, and 4d.

NUMBER OF PEOPLE EMPLOYED AND LABOUR'S
SHARE OF TOTAL PRODUCTION COSTS



Source: Table IV

Figure 4a

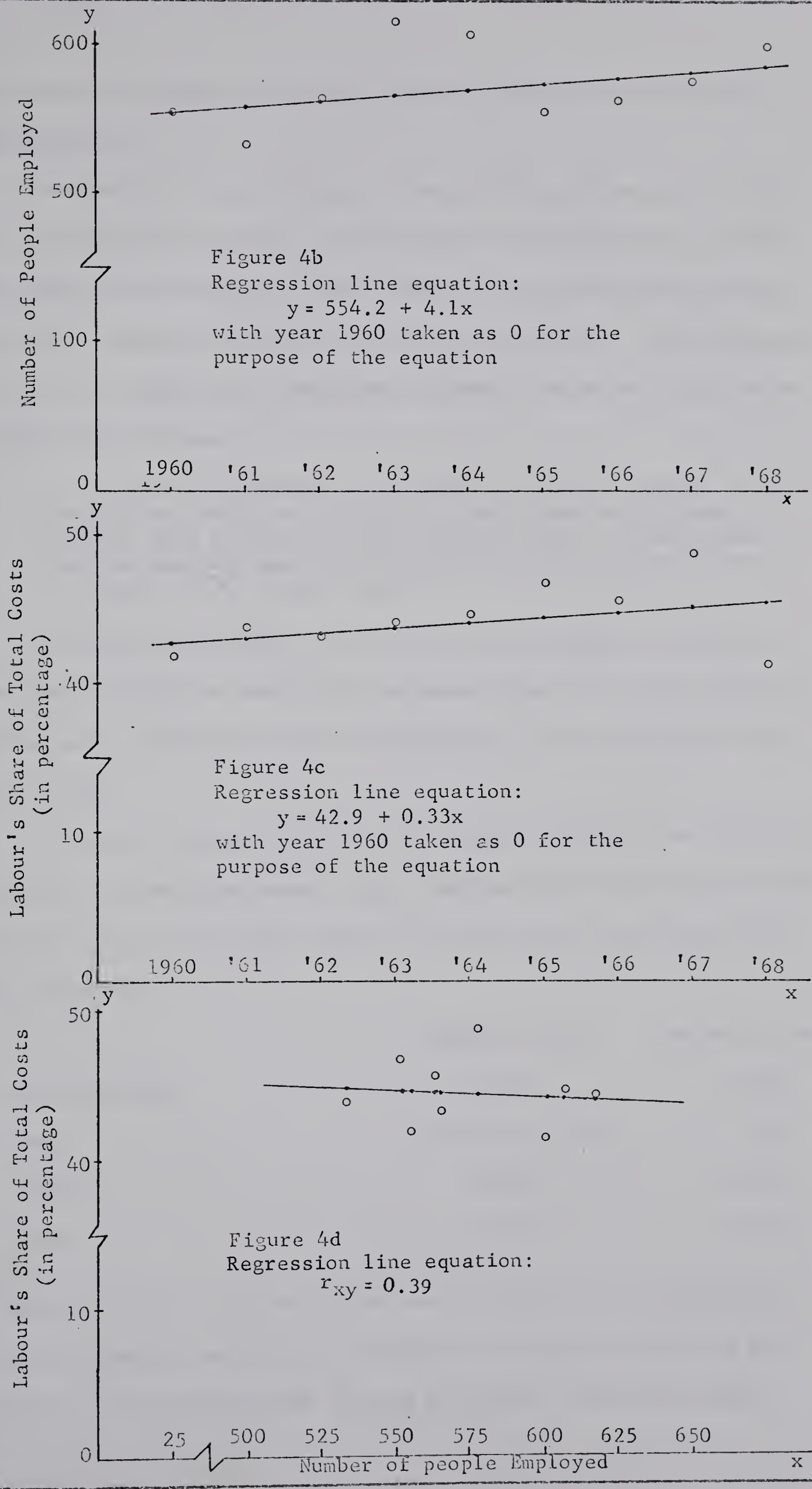


Figure 4b
Regression line equation:
$y = 554.2 + 4.1x$
with year 1960 taken as 0 for the purpose of the equation

Figure 4c
Regression line equation:
$y = 42.9 + 0.33x$
with year 1960 taken as 0 for the purpose of the equation

Figure 4d
Regression line equation:
$r_{xy} = 0.39$

variations in the number of people employed during the period 1960 - 1968 (Fig. 4d).

According to the industry spokesman, the percentage of total costs attributable to labour will henceforth be affected by a factor which was put into effect in 1968. This is the allocation of costs between the company's Head Office and their factories. The spokesman felt that the significant reduction in labour's share of total costs in 1968 (Table IV) was

> . . .partly the result of a tighter control of people, and partly the result of a change in the allocation of cost between Head Office and the factories, that is, factories are now bearing some cost that they formerly did not, such as depreciation. (pers. comm.)

At the Burnaby plant, the situation was slightly different. From 1966 to 1968, the work force increased from 120 to 200 while the percentage of production costs attributable to labour decreased from 40.0 to 33.0.

From the analysis that we have so far been doing has emerged the structure of production costs. This structure is revealed below by the percentages which the inputs form of the total costs incurred by the whole operation:

	Redcliff Plant	Burnaby Plant
Raw Materials	25.0%	27.0%
Fuel	(practically nil)	7.0%
Labour	44.5%	37.7%
TOTAL	69.5%	71.7%

The balance of 30.5 per cent in the cost structure at the Redcliff plant is shared by fuel costs and capital investment, while the 28.3 per cent at the Burnaby plant is held by capital investment alone.

What stands out very clearly is that despite the tremendous technological progress and the large-scale use of automation, the glass-container industry of Western Canada is still labour-intensive. According to Pitfield et al, (1967 p. 6), since the industry is labour-intensive, and since "the upward pressure on wage costs can be expected to continue with a resulting steady pressure on profit margins, further automation. . .will be necessary." Despite the labour-intensive nature of this industry, wage levels have apparently had little or no significance as a location factor.

CHAPTER III

THE NATURE AND THE DISTRIBUTION OF THE MARKETS SERVED

In the previous chapter, the spatial distribution of the inputs used in the manufacture of the glass containers was examined. Just as the spatial relationship between the sources of the inputs and the location of the industry was analyzed and evaluated, in the same manner should the spatial distribution of the finished products be studied. The pattern of the distribution is analyzed in relation to the location of the manufacturing plant. To make the distribution of the finished products more meaningful, other spatially distributed elements which account for, or influence, the pattern of the distribution of the glass containers should also be examined. The pattern of the distribution is revealed by mapping the destinations to which the products are sent. These destinations can be classified into two categories. The first category includes all the places where the products are regarded as completely finished products, and are directly consumed. The other category consists of the places where the products are re-used in one or several other ways in the manufacture of other products.

Although these two categories differ in nature, they each constitute the market for the industries which supply them with the particular products. For "a 'market' is often more a derived than an original feature." (Estall and Buchanan, 1964, p. 30) Consequently, the market may be the location of another industry, or it may be the place where the final 'individual' consumer buys the product. Whichever type of market is served by any industry depends on the nature of the product the industry manufactures.

Glass containers belong to the group of products which are not directly consumed by the individual customer. Rather, they are used by some other industries for bottling their products. Generally speaking, the market for the glass-container industry is constituted by some industries which manufacture products that are bottled. There are, in Western Canada, a large number of these bottling industries, and some of them use the containers which are manufactured by the Redcliff and the Burnaby plants. An examination of the location pattern of these industries, and the quantities of glass containers each buys from the plants will provide us with the pattern of distribution of the glass containers.

The industries which use glass containers to bottle their products fall roughly into the following categories: food, beverages,[1] drugs and cosmetics, and chemicals. According to the tonnage of glass containers purchased by these customers, the beverage industry emerges as the single major consumer of the glass containers manufactured in Redcliff and Burnaby. On the average, the beverage industries consume 55 per cent and 60 per cent of the glass containers manufactured by the Redcliff and Burnaby plants respectively. This means that of the total of 96,000 tons of glass containers which the two plants manufactured in 1968, 53,850 tons were used by the beverage industry in bottling their products. The group of industries which constitute the second largest market for the two plants is the food packing industry. Thirty per cent (or 22,500 tons) of Redcliff's output and 35 per cent (or 7,350 tons) of the Burnaby plant's output in 1968 went to the food-packing industry. The remainder of 11,250 tons (or 15 per cent) of

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[1]The use of the word 'beverage' in this context includes breweries, distilleries, wineries, and soft drinks manufacturing industries.

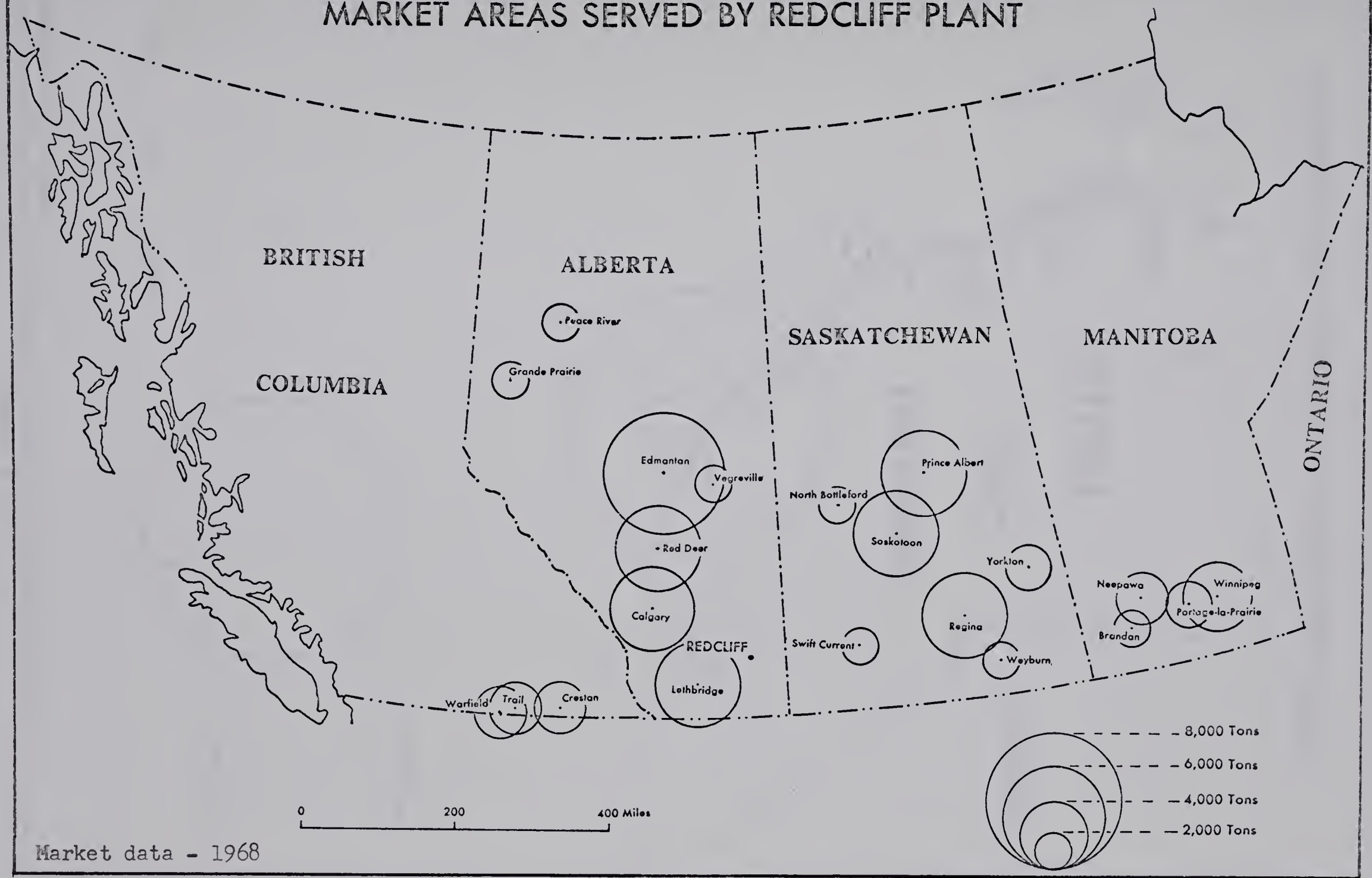
the output from the Redcliff plant, and 1,050 tons (or five per cent) of the output from Burnaby, was bought by the drugs, cosmetics and chemical industries.

The breakdown which we have done above tells us the types of industries which constitute the market for the glass-container industry in Western Canada, and also the quantity which each of these groups of industries consumes of the total output from each factory. However, this analysis does not show the spatial distribution of the glass containers. This will be revealed when we examine the destinations to which the glass containers are shipped from Redcliff and Burnaby.

Figures 5 and 6 show the distribution of the glass containers manufactured by the Redcliff and Burnaby plants. It shows also the tonnage which is consumed at the various centres to which the products are shipped. These cities and towns, shown on the maps, are therefore, the markets for the two glass-container manufacturing industries located in Redcliff and Burnaby. Studied more closely, the maps show that the products from the plant in Redcliff have a wider spatial distribution than the products of the plant in Burnaby. While the market area for the latter is confined to British Columbia, and is all within a radius of 500 miles (Fig. 6), Fig. 5 shows that the plant in Redcliff serves all the provinces of Western Canada, including British Columbia. The farthest important market centre for the Redcliff plant is Winnipeg, a distance of 653 highway miles. Peace River is 664 miles away, but bought 2,000 tons of glass containers, 3,000 less than the tonnage used in Winnipeg.

Of all the markets which the Redcliff plant serves in the four provinces, the Alberta market is the largest, consuming 37.3 per cent of the total output of glass containers. The percentages which are

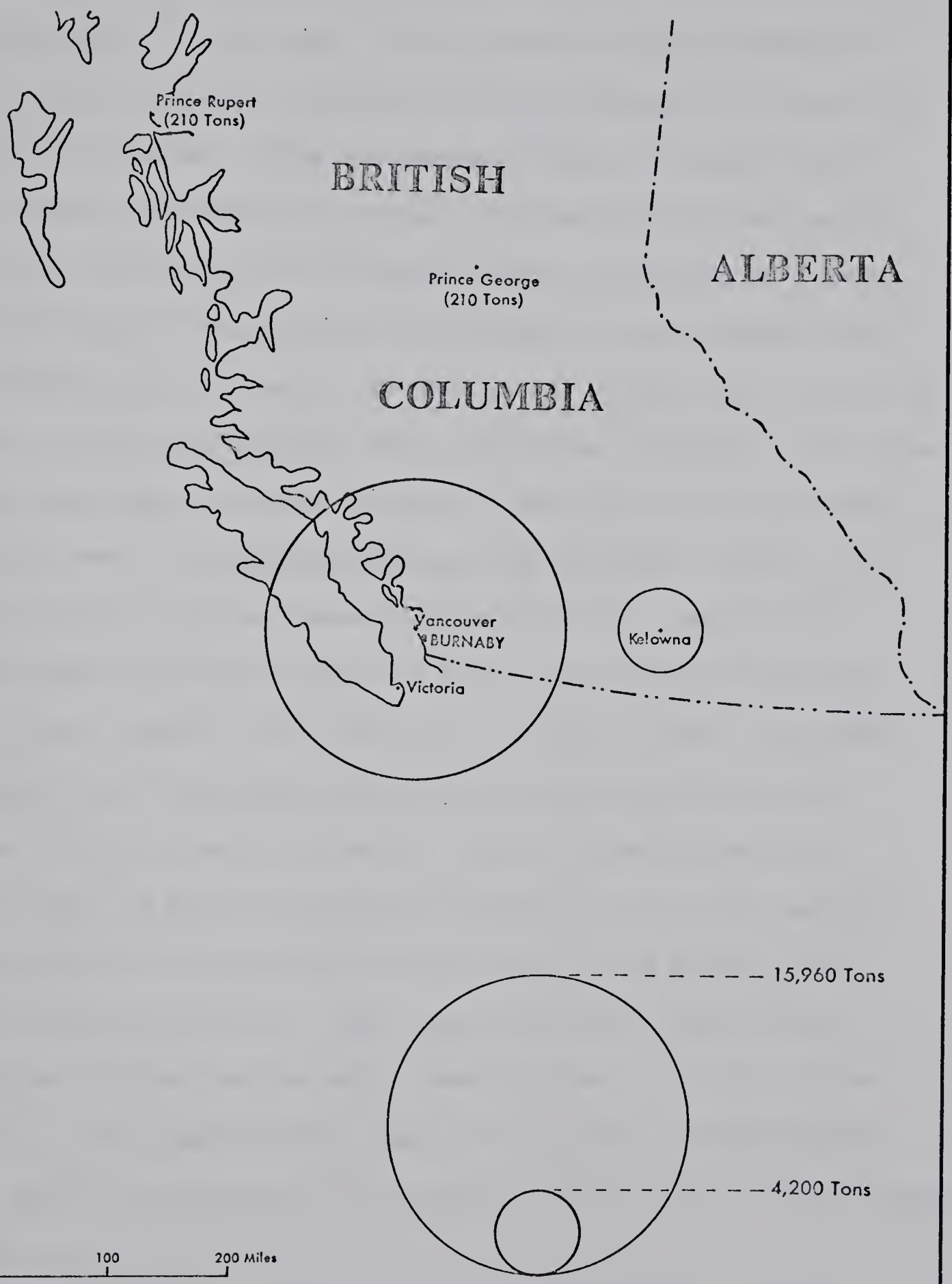
MARKET AREAS SERVED BY REDCLIFF PLANT



Market data - 1968

Figure 5

MARKET AREAS SERVED BY BURNABY PLANT



Market data - 1968

Figure 6

shipped to the Saskatchewan and Manitoba markets decrease eastwards. While the market areas in the former province take 31.8 per cent of the total output of the glass containers from the Redcliff plant, the latter buys only 15.3 per cent. The portion of British Columbia's market which is served by the Redcliff plant consumes only 12 per cent of the plant's output. These percentages reflect two things. The first is that the farther any province is from Redcliff, the less it buys of the total output of the plant. This is explained by the fact that the product is fragile and does not easily stand transportation over long distances. Also, the product is not of such high value as to be able to absorb high freight rates. According to Mingay,[2] "400 miles is about the maximum economic distance to ship glass containers from factory to user." (Vancouver Province, August, 1968) However, the writer feels that this statement needs elaboration. The 400-mile economic limit may be operative in a market area which is shared by more than one company, as for instance, in Eastern Canada. But where the market area is served by just one plant, the maximum economic distance is quite likely to flexible. This is shown by the fact that the plant in Redcliff supplies customers who are as far away as Grande Prairie and Peace River which are 645 and 664 highway miles respectively from Redcliff. Also, each of the four cities served in Manitoba is more than 500 miles from the plant. For this reason, the factor of distance is only a part of the answer for the Manitoba market areas' low consumption of the output from Redcliff. This is borne

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[2]J. Donald Mingay is the president of the Consumers Glass Company Limited.

out by the fact that some cities which are closer to Redcliff are reported to have used smaller amounts of the glass containers manufactured in Redcliff than have some other cities which are farther away from Redcliff. For instance, Swift Current, which is 140 miles from Redcliff, used only 2,000 tons of Redcliff's glass containers while Winnipeg, which is 653 miles from Redcliff, used 5,000 tons of the glass containers manufactured in Redcliff in 1968. This is shown in Table V where the cities are listed in order of their population size. The third and fourth columns in the table show that the tonnage

TABLE V - TONNAGE OF GLASS CONTAINERS USED AS RELATED TO SIZE OF CITY AND DISTANCE FROM REDCLIFF

CITY	POPULATION*	TONNAGE OF GLASS CONTAINERS CONSUMED	DISTANCE FROM REDCLIFF (Miles)
Edmonton	376,925	7,000	362
Calgary	330,575	5,000	182
Winnipeg	257,005	5,000	653
Regina	131,127	5,000	292
Saskatoon	115,892	5,000	322
Lethbridge	37,186	5,000	105
Brandon	29,981	2,800	518
Prince Albert	26,269	5,000	429
Red Deer	26,171	5,000	266
Swift Current	14,485	2,000	140
Portage-la-Prairie	13,012	2,000	600
Yorkton	12,645	2,800	430
North Battleford	12,262	2,000	344
Trail	11,600	3,000	452
Grande Prairie	11,417	2,000	645
Weyburn	9,000	2,000	341
Peace River	4,087	2,000	664
Vegerville	3,598	2,000	290
Neepawa	3,229	3,000	556
Creston	2,920	3,000	367
Warfield	2,255	3,000	502

*Population figures are taken from the Census of Canada, Population, 1966, Volume 1, D.B.S.

of glass containers consumed in each city does not necessarily decrease with increasing distance from Redcliff. What the table does show, although not to any great extent, is the fact that the smaller the city, the smaller is the tonnage of glass containers shipped there. It can be seen from the table that of the nine cities which had more than 25,000 people each in 1966, only Brandon used less than 5,000 tons of the glass containers manufactured in Redcliff in 1968. The possible inference one can make from this is that the beverage and food-packing industries which use glass containers for bottling their products are generally located in large urban centres (Estall and Buchanan, 1964, pp. 30-35).

Manitoba's low consumption of the glass containers manufactured in Redcliff is due to the fact that the Manitoba market is closer to Ontario where three glass-container manufacturing plants are located.[3] These three plants supply the bulk of the glass containers used in Manitoba.

A comparison of Figures 5 and 6 shows that the British Columbia market is shared by both the Burnaby and the Redcliff plants. This is a development which has a historical element. Before the Dominion Glass Company built its Burnaby plant in 1964-65, their Redcliff factory served the British Columbia market. But since the plant in Burnaby started production, it has taken over the Vancouver-Victoria market area in addition to the rather small areas of Prince George and Prince Rupert. Yet the total output by the factory is still low. Although within three years, 1966 to 1968 inclusive, the plant has increased its output by 200 per cent,[4] the demand in British Columbia

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[3]Of the three plants, two, in Hamilton and Wallaceburg, belong to the Dominion Glass Company. The third, in Toronto, belongs to Consumers Glass Company.

[4]In 1966, the plant manufactured 7,000 tons of glass containers; in 1968 21,000 tons.

for glass containers is more than can be met by the factory's present output, hence the supply of 9,000 tons of glass containers in 1968 by the Redcliff plant. Nevertheless, it is necessary to point out that only one of the areas which receive their supplies from Redcliff is within what Mingay calls "the maximum economic distance." This is Creston which is 367 highway miles from Redcliff. The others - Trail and Warfield - are 452 and 502 highway miles respectively from Redcliff. This would also seem to underscore the flexibility of "the maximum economic distance."

It is necessary to point out that these three market centres of Creston, Trail and Warfield are clearly separated from the large Vancouver-Victoria market area which the Burnaby plant serves. Thus the market areas for the two plants do not overlap. That the market areas do not overlap may be explained simply by the fact that both the Redcliff and Burnaby plants belong to the same company; it is likely, therefore, that they would not compete in the same market area.

The distribution of the market areas is governed, and largely accounted for, by the spatial distribution of another geographical element, namely, population concentrations. This is demonstrated vividly in Alberta and Saskatchewan which together consume 69.1 per cent of the total output from Redcliff, and also by the British Columbia market areas which the Burnaby plant serves.

There are seven market areas each in Alberta and Saskatchewan. Taken together, 92.3 per cent of the market areas in the two provinces lie south of parallel 55°N, an area which holds 91.5 per cent of the population of both provinces.[5] Only Grande Prairie and Peace River lie

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[5]The percentage was calculated from the D.B.S. Census figures,1966.

north of the parallel 55°N. Together, they consumed only 4,000 tons of the 51,800 tons of glass containers marketed in Alberta and Saskatchewan in 1968.

Table VI gives groups of cities, the percentages which their population forms of the total for the province in which they are located, and the percentages which each of the groups consumes of the glass containers shipped into the province from Redcliff.

TABLE VI - THE RELATIONSHIP BETWEEN CITY GROUPS, THEIR PERCENTAGES OF PROVINCIAL POPULATION, AND PERCENTAGES CONSUMED OF REDCLIFF'S GLASS CONTAINERS MARKETED IN THE PROVINCE

PROVINCE	GROUPS OF CITIES	POPULATION: % OF PROVINCIAL TOTAL	% OF GLASS CONTAINERS CONSUMED
ALBERTA	Calgary & Edmonton	42.3	42.9
	Calgary, Edmonton & Lethbridge	52.3	60.7
	Calgary, Edmonton, Lethbridge & Red Deer	54.1	78.6
SASKATCHEWAN	Regina & Saskatoon	25.8	42.0
	Regina, Saskatoon & Prince Albert	28.4	63.0
	Regina, Saskatoon, Prince Albert & Swift Current	29.9	71.4

From the table, it can be found that as the group of cities increases, the portion which they consume of the total tonnage of containers increases. For instance, Calgary and Edmonton together consume 42.9 per cent of the quantity which is marketed in Alberta. When Lethbridge is added to the group, the percentage consumed increases by approximately 18 to 60.7. And there is a further increase of just under 18 to 78.6

when the city grouping is widened to include Red Deer. Together, therefore, the four cities, with 54.1 per cent of the population of the province have industries which use 78.6 per cent of the glass containers marketed in Alberta. That the percentage consumed of the glass containers increased faster than the percentage of the provincial population may be explained by the fact that it is in the large urban centres that the majority of the glass-container-using industries are generally concentrated. This is revealed more in Saskatchewan than it is in Alberta. As can be seen from the table, the percentage consumption of glass containers in Saskatchewan increases much faster than does the percentages of the provincial population supported by the various city groupings.

Thus, so far, the percentages which the various city groupings consume of the amount of glass containers marketed in Alberta and Saskatchewan are very close. The only major differences found are the proportions of the population of each province which the different city groupings support. This is explained by the fact that in Alberta, population is heavily concentrated in a few major cities, while in Saskatchewan it is fairly evenly distributed in many more urban centres.

Perhaps, the impression has so far been given that all the glass containers used in Western Canada are of domestic origin. But this is not so. The four provinces of Western Canada import a substantial amount of glass containers, not only from the United States but also from overseas.[6] In 1966, the imports amounted to $1,118,977.00 by value. Compared with a total purchase by value of $7,575,000.00 by

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[6]The overseas countries which export glass containers to Western Canada are the United Kingdom, West Germany, Italy, Portugal, Hong Kong, and Japan (Alberta Bureau of Statistics, Imports by Commodities, December, 1966).

the four provinces, the imports then accounted for 14.8 per cent of all the glass containers used in the provinces.[7] This would suggest that the production of the plants operating in Western Canada could be increased if the domestic producers were to increase their share of the market at the expense of imports.

British Columbia imports more glass containers than does any of the other three provinces. Of the total import by value of $1,118,977.00 in 1966, $1,061,567.00 (or 95.7 per cent) was for the British Columbia market alone. Saskatchewan was the lowest importer, followed by Alberta. The two provinces imported $3,284.00 and $7,682.00 worth of glass containers respectively. Manitoba's imports amounted to $46,958.00.

That imports by Saskatchewan and Alberta were the lowest may be attributed to the fact that the two provinces are cut off from other sources by distance. Also, it is probably because of Redcliff's fairly central location with respect to both provinces. Imports into British Columbia were so high because the output from the Burnaby plant was (and still is) low. Moreover, the plant in Redcliff cannot be expected to supply British Columbia with more glass containers since it does not fully satisfy the demand from its immediate markets in Alberta and Saskatchewan.

Estimates by the Alberta Bureau of Statistics (1967) indicate that the per capita consumption of glass containers in Western Canada amounted to the value of $1.43. On the basis of population, therefore, the provincial consumption of glass containers in 1967 were as given

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[7] The import figures are not obtainable in tonnages since the Alberta Bureau of Statistics, the source of these figures, collects data only by value and not by tonnage.

in Table VII below.

TABLE VII - PROVINCIAL CONSUMPTION OF GLASS CONTAINERS BY VALUE 1967

PROVINCE	POPULATION	VALUE OF GLASS CONTAINERS CONSUMED
British Columbia	1,873,674	$2,679,353.82
Alberta	1,463,203	$2,092,380.29
Saskatchewan	955,344	$1,366,141.92
Manitoba	963,066	$1,377,184.38
TOTAL	5,255,287	$7,515,060.41

*Population figures are taken from the Census of Canada, Population, 1966, Volume 1, D.B.S.

As has already been pointed out, only 14.8 per cent of the total value of glass containers consumed in Western Canada in 1967 was imported. It follows that the domestic production satisfied 85.2 per cent of the market demand. But the growing population of Western Canada indicates that there will be an increase in demand for glass containers. The Dominion Glass Company and the Consumers Glass Company have realized this and have already initiated programmes aimed at increasing production. This will be looked at in greater detail in Chapter V.

So far, the distribution of the market areas which the Redcliff and the Burnaby glass-container manufacturing industries serve have been examined. The nature and structure of the market, the industries which use glass containers, and the quantities they buy from the two plants operating in Western Canada today, have been revealed. If the

previous chapter is combined with the current one, then the spatial relationship between the sources of the inputs used, the locations of the two plants which transform the raw materials into the finished products, and the market areas to which the products are sent shall have been seen. It is now time to examine the factors which probably influenced the choice of site for the plants.

CHAPTER IV

SITE CONSIDERATIONS

The previous two chapters analyzed and evaluated, on the one hand, the spatial relationship between the locations of the glass-container manufacturing plants and the sources of the inputs which they use, and on the other hand, the relationship between the plants and their market areas. It is necessary at this stage to examine the degree to which the distribution of the inputs, the market centres, and other locational factors influenced the choice of the particular sites where the plants are located.

Studies in industrial locational analysis have produced some hypotheses which attempt to explain why manufacturing activities are located where they are. The studies have revealed that some industries are located close to their raw materials and others close to their market areas. A third group, known as 'mobile' or 'footloose' industries, are those located somewhere between the sources of their raw materials and the markets (Hoover, 1963, p. 36; Estall and Buchanan, 1964, p. 20; Alexandersson, 1967, p. 7). It is said also that different industries may belong to the same location group for different reasons. However, each location may be explained by examining the nature and distribution of its raw materials, the processes using them, the nature of the finished products, and the type and distribution of the markets served. In many cases, the transportation system is used as a key to explain the location (Broek and Webb, 1968, p. 285).

There are various types of raw-material-oriented industries. All manufacturing activities which process bulky, perishable, weight-losing or waste-producing raw materials are generally located close to the

sources of these raw materials. Sugar refineries are examples of industries which process bulky and weight-losing materials - sugar cane and sugar beet - while food and fruit canneries use perishable raw materials. On the other hand, where it is cheaper to transport a unit weight of the raw materials than the same unit weight of the finished product, the industry is located in or near the market. Similarly, if the finished product is bulky, fragile, or perishable, the industry is located close to the consumer. Some food products, such as bread and ice-cream, are perishable; beverages and household chemicals in bottle containers are bulky, low-value goods. All the industries manufacturing these products are therefore located in or near the market area. Unlike the raw materials-oriented and market-oriented industries, the so-called footloose industries are those which do not seem to be tied down by any particular locational factor (Hoover, 1963, pp. 27-46; Estall and Buchanan, 1964, pp. 17-35). With these observations in mind, let us analyze and evaluate the factors which were likely to have influenced the choice of Redcliff and Burnaby as the sites for the two glass-container manufacturing plants.

In studying Figures 2 and 3, it was found that of the four principal raw materials used, only limestone is obtained from within the province in which each glass-container manufacturing plant is located. If it is remembered that this raw material forms less than one-fifth of the batch mixture, then it is possible that its influence as a locational factor, in relation to the other raw materials, is less significant.

Not only do Figures 2 and 3 show that the plants draw from different sources, but also that a substantial portion of their raw materials comes from the United States. This wide distribution of the

raw materials would seem to reduce significantly the possibility of raw-material orientation.

Considered in terms of the market areas served, however, the situation regarding the location of the plants is different. As has already been indicated, industries which manufacture bulky, low-value, or fragile goods tend to be located in or close to their market areas. Figure 5 shows the Redcliff plant as being almost centrally located in its market area, while the Burnaby plant has an advantage of proximity to its main market centre, the Vancouver-Victoria area (Fig. 6).

Like most other containers, the products from the Burnaby and Redcliff plants are bulky and fragile. This, coupled with the fact that freight rates on finished products are higher than on raw materials (Estall and Buchanan, 1964, p. 38),[1] explains the desirability of a location close to the markets which the industry serves. Griffiths emphasises the importance of a location close to the market: "Generally speaking, the most important consideration in locating a Glass Container Plant [sic] is the proximity of the market, because outbound freight is probably the largest single cost factor in any location study." (pers. comm.)[2] It is possible that Mingay was referring to the combined effects of fragility and freight rates when he said that the longest distance over which glass containers could be transported economically is 400 miles.

Relating the total effects of the bulky and fragile nature of the glass containers on the one hand, and the freight rates on the other, to the location of the two plants, it is quite easy to see why the

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[1]The average freight rate on glass containers shipped to customers in Alberta is $0.036 per ton mile, and $0.058 per ton mile to Saskatchewan. But raw materials bear an average freight rate of $0.018 per ton mile.

[2]A. F. Griffiths; vide footnote on p. 19.

plants are well-situated with respect to their markets.

After the general area for the location of a glass-container manufacturing plant has been assessed, the choice of the particular site does not pose severe problems. While the site for some industries has to be chosen with a consideration of the amount of water supply, or enough space for waste treatment plants, a glass-container manufacturing plant does not appear to be rigidly bound to any of these site factors. According to the industry spokesman, water is not a limiting factor in the location of a glass-container manufacturing plant; neither does waste disposal pose any serious problem (pers. comm.). What is necessary is only a good sewer system. However, one or two factors are taken into consideration when site decisions are being made for a glass container plant. One of these is a strong enough soil base to hold the weight of the factory, and the other is a reasonably large space to accommodate the necessary structures, including a large warehouse. This space must be large enough to provide for the future expansion of the industry. But most important of all is the need for the site to have access to an efficient communications system. This is important particularly because the raw materials are brought to the plant mainly by rail while the finished products leave largely by truck. To what extent then do the locations of the plants in Burnaby and Redcliff reflect the influence of these site factors?

It must be remembered that the two plants were built at different periods. The conditions prevailing in 1964-65 when the Burnaby plant was built differed from the conditions in 1913 when the Redcliff site was chosen. It would seem obvious that some factors which influenced the choice of site during the early decades of the century are probably not very significant today. This seems to be reflected by the location

of the two plants as they are today, in Redcliff and Burnaby.

The answers obtained from the questionnaires suggest that it was the size of the British Columbia market which attracted the Dominion Glass Company to locate a plant in the province. This sounds quite logical since British Columbia, by virtue of its total population, consumes more glass containers per year than any other province in Western Canada (Table VII). Moreover, before the Burnaby plant was built, all the glass containers used in the province were imported from Alberta and overseas. Furthermore, it was found that silica sand (which forms more than 50 per cent of the raw materials used) can be obtained from nearby Washington. This was advantageous because Washington is closer to British Columbia than Manitoba or Minnesota is to Alberta.

Although it was not explicitly stated, the writer feels that the Dominion Glass Company realized the potential growth in demand for glass containers in Western Canada as a whole, and in British Columbia in particular. They therefore took steps to meet this anticipated demand by building the Burnaby plant. Together with their plant in Redcliff, this gives them a strong base in the Western Canada market.

With the general economic situation favouring the location of a glass container manufacturing plant in British Columbia, the site for Burnaby seems to have been chosen for two reasons. The first, and perhaps the more important, is the fact that the largest concentrations of population in British Columbia are in the Vancouver-Victoria area. It is also in this part of the province that most of the industries which use glass containers are located. Burnaby, is actually a suburb of Vancouver, and is about only 45 miles from Victoria. Together, the Vancouver-Victoria area is the largest market centre in the province.

The location of the plant in Burnaby significantly reduces freight costs on finished products shipped to customers in the Vancouver-Victoria area where about 77 per cent of the factory's output is consumed (Fig. 6). Secondly, Burnaby is said to have been chosen because of its favourable municipal tax structure (pers. comm.).

The reasons for the choice of the Redcliff site in 1913 were slightly different from those which explain the choice of Burnaby in 1964. The glass-container industry was attracted to Redcliff by the economic boom which the town enjoyed during the early part of the second decade of the present century. This economic boom, however, was brought about by the discovery of natural gas which formed the basis of the most significant industries of the province at that time. Redcliff then became the industrial centre of Alberta (C. T. Hall, 1962; Department of Industry and Development, Alberta, 1963). The variety of manufacturing activities going on in the town created what could then be described as a geographical concentration of industries.[3] So it was that the industrial climate, the increasing population, and the availability of natural gas all worked together making Redcliff the most attractive site for the glass-container industry as well as for other industries.

But this economic growth was short-lived. "With the outbreak of World War I in 1914 the majority of the firms were forced to close due to the limited market and loss of manpower." (Department of Industry and Development, Alberta, 1963) However, the glass-container plant

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[3]Some of the industries located in Redcliff then were an automobile plant, brick industries, a steel mill, apparel factories, furniture manufacturers, coal mining, and a cigar factory (C. T. Hall, 1962; Department of Industry and Development, 1963).

survived. Its survival was probably due to the fact that the Dominion Glass Company had then grown into a large enterprise, and was therefore able to withstand the difficulties which the younger and smaller industries could not meet. Also, by this time, the Dominion Glass Company had bought natural gas rights from the Canadian Western Power and Fuel Company. This investment must also have contributed to the survival of their plant since, by their accounting method, fuel costs became almost negligible in the total production costs.

What emerges from the above analysis is the fact that the Redcliff and Burnaby sites were chosen for different reasons. The factors which influenced the choice of the sites were reflected in the economic conditions of the different periods during which each plant was built. It is this which has culminated in the market-oriented location of the Burnaby plant. On the other hand, the Redcliff site could be regarded today as one of industrial inertia since the contributing factor of industrial agglomeration no longer exists. Nevertheless, natural gas, which is said to have been the primary attractive factor, still abounds in the area. The pull which it had on the industry has, however, diminished. Today, it is easy to transport natural gas via pipelines over long distances. Although it cannot be said with certainty, it is possible that had natural gas been transportable in 1913, the industry would probably have remained in Manitoba. Or if it was still necessary to move it to Alberta, then it probably would have been located closer to or in one of the large cities - either Edmonton or Calgary.

The conclusions to be drawn from the above analysis would seem to point out an interesting phenomenon. The same reasons may not account completely for the location of any two industrial activities even if they both produce the same goods. Thus, although the two plants in question

manufacture the same products and even belong to the same company, the sites for their location were chosen for completely different reasons. While it was primarily the discovery of natural gas and, secondarily, the industrial boom which attracted the glass-container manufacturing plant from Beauséjour to Redcliff, the Burnaby site was chosen because of its proximity to the Vancouver-Victoria market area, and also because of its favourable municipal tax structure.

CHAPTER V

POSSIBLE FUTURE TRENDS OF THE INDUSTRY, SUMMARY AND CONCLUSIONS

The preceding chapters studied not only the past, but also the recent developments in the glass-container industry in Western Canada. By analyzing and examining the nature, structure and the operations of the industry, the tremendous development which has taken place since the industry was first established in Western Canada was noted. The increase in population, the growth of settlements, and the development of transportation facilities have widened the sphere of influence of the glass-container manufacturing plants in Redcliff and Burnaby. The first glass container factories in the region were local in outlook. Their raw materials were obtained not too far from the works, and their finished products were sold to local consumers.

By 1915, however, things had taken a different turn. Only two glass-container manufacturing plants were left in Western Canada, one in Beauséjour, Manitoba, and the other in Redcliff, Alberta. As the industry developed, there began an areal expansion as regards the spatial relationship between the plants and the sources of their raw materials, and the market centres which they served. Raw materials were obtained from more distant sources, and the markets were no longer confined to only local businesses. It was from this stage that the industry developed into what it is today in Western Canada. The next question to ask then, is, what future prospects does the industry have?

The answer to this question may be arrived at by measuring the economics of the industry today against some factors on which its general performance depends.

Of all the economic indices, market conditions are, perhaps, one

of the key factors in the future trend of the glass-container industry, as indeed it is for all industries. In a general way, market conditions are a reflection of the general economic trend. In addition, the performance of the glass-container industry is closely related to the growth of the population. This is particularly important because, as has already been noted in Chapter III, about 90 per cent of the finished glass containers are used for bottling a wide variety of beverages and food products. An increase in population will consequently lead to an increase in the demand for glass containers.

Calculations from census data show that the population of western Canada as a whole has been increasing at the average annual rate of 4.8 per cent since the turn of the century. This rapid increase in population in the region has been due mainly to the economic growth which has taken place in this part of the country during this period. The combined effects of this economic and population growth have led to an increase in the consumption of glass containers.

During the past few decades, the output of all the Canadian glass-container manufacturing plants has grown at the average annual rate of about five per cent. At the same time, the average rate of annual sales in dollars increased at 6.5 per cent, 1.5 per cent faster than the production rate, owing to periodic price increases (Pitfield et al, 1967 p. 8). Estimates show that in 1965 there was a per capita consumption of 94 glass containers in Canada, and it is expected that if the present trends continue, the national industry sales should rise to at least seven per cent per year (Pitfield et al, 1967, p. 3). This expected rate of increase is based not only on the growth of the population and the economy, but also on the likelihood that the corbonated beverage and brewing industries across Canada will shortly adopt the disposable bottle.

However, there are two other factors which may affect the apparently promising future of the glass-container industry, though the degree to which the influence of each may be felt is difficult to forecast. Firstly, competition from the industries which manufacture other types of containers is likely to reduce the demand for glass containers in some portions of the market. Secondly, the industry may encounter a problem with some provincial governments which might ban the usage of the disposable bottle.

The nature of the particular problems facing different types of glass-containers as a result of the competition from containers made of other materials depends on how well these latter containers lend themselves to the products for which they may be used. Of the many types of these containers, those made of metals or plastics present the severest competition to glass containers. Nevertheless, each type of container is best suited for a different section of the market. Thus glass containers are being used more extensively in the food-packaging industry while plastic containers continue to make inroads into the household chemical industry - detergents and bleaches, for example. Unlike glass containers, metal cans are not fragile, and are more easily portable. Although they have a substantial part of the food industry, their share of the market seems to be declining since food cannot be stored in open cans (Financial Post, October, 1964). Moreover, unlike cans and plastics, glass containers have been found to appeal to shoppers more because they offer inertness, visibility, strength and declosure. The customer's curiousity is satisfied when he sees the nature of what he is buying (Modern Packaging, 1967). Furthermore, glass containers do not effect any chemical reaction with the products that are bottled in them as cans sometimes do. But in spite

of their apparent advantages for summer activities (quick cooling, portability, no returns), cans are not making further inroads into the packaging industry. This has been attributed to consumer apathy towards cans. Such apathy is reflected in the fact that within a period of ten years, canned beer captured only three per cent of the Canadian beer market. The poor performance of canned beer in Canada is believed to be due to the fact that canned beer forms about only one per cent of the total beer advertising (Marketing, July, 1960).

If these past and present conditions are an indication of future trends, then it is likely that the glass-container industry is in a position to meet any further challenge from cans and plastic containers. However, the extent to which this may be possible depends, in part, on whether or not the disposable bottles are banned. It is difficult to say what may come out of the outcry against the one-way bottle in some parts of Western Canada. At the moment, the governments of three of the four provinces - Manitoba, Saskatchewan and Alberta - have indicated a desire to have the non-returnable bottle banned. Yet none of them has decided what should be done. Alberta, the most outspoken of the three, has appealed to the federal government to impose the ban; but there is no indication as to what measures, if any, the federal government will take (Financial Post, May, 1968). Nevertheless, it seems the non-returnable bottle has come to stay. This is because reaction to the one-way bottle varies all over the country. The provinces of Quebec, New Brunswick, Prince Edward Island and Newfoundland have made no attempt to ban this type of bottle, and it has been realized that action by just a few provinces could cause bottling facilities to move to other provinces (The Edmonton Journal, July, 1968). Moreover, the major soft drinks companies and food retailers - Coca-Cola Limited

and Canada Safeway Limited, for instance - now sell some of their products in disposable glass containers. Apart from these, the glass-container manufacturing companies, the bottling industries, and the retail companies have put pressure on the provincial governments not to ban this new type of glass container (Financial Post, May, 1968).

The reason for the interest in the disposable bottle on the part of the manufacturers and the handlers is readily evident. To the manufacturers, the use of the one-way glass container will increase their output. The bottling industries find that it reduces the demand for washing and sterilizing, while to the retail companies it eliminates the problem of storing empty bottles for return, and bottle-handling costs are reduced (Printers Ink, 1966 and 1967).

During an interview with the spokesman for the Dominion Glass Company, the writer was told that the industry is hopeful about the future, and feels that the non-returnable bottle will not be banned. But despite this confidence, it was found that a new development is emerging in the industry. Rather than manufacture only glass containers and face competition from other containers, the industry has entered the plastic container market, and the Dominion Glass Company has a plastic container manufacturing plant in Toronto. According to the spokesman, this is a new trend which was started by the glass-container manufacturers in the United States.

The way in which the glass-container industry is meeting the challenge from other types of containers, and the increasing population of Western Canada seem to indicate that the industry will continue to expand. This is underscored by the fact that the present output by the two plants is insufficient to satisfy the demand in the region. This is why a substantial amount of glass containers is imported from

overseas as was noted in Chapter III. Moreover, it has been estimated that glass container needs in the region will grow at the annual rate of 5.5 per cent. It was the evaluation of these prospects which made the Consumers Glass Company decide to build a plant in Western Canada. This plant is now under construction at Coldstream in the Okanagan Valley near Vernon, British Columbia, and is expected to go into production in the fall of this year (Financial Post, August, 1968).

It is necessary to examine the locational factors which led to the choice of Coldstream, and also the changes that are likely to come about in the distribution and share of the glass-container consumer market which the three plants will serve.

As we have already found, the choice of a location for any industry is decided, in many cases, by the economics of assembling the inputs from different sources, and of distributing the finished products among the customers. The location of a glass-container manufacturing plant in Western Canada, as has already been seen, cannot be raw materials-oriented since, at present, less than 20 per cent of the raw materials is obtained from within the region. Instead, it was found that the plants were located in or close to their market areas. The Consumers Glass Company's new plant is to serve Western Canada. But unlike the Dominion Glass Company's plant in Redcliff, it is unlikely that it will serve all the four provinces in the region. One is led to this conclusion since Mingay indicated that the farthest distance over which glass containers could be transported economically is 400 miles. If this distance limit is applied, then the plant will be limited to only the British Columbia and Alberta markets. What factors then were likely to have influenced the choice of the Coldstream site?

Coldstream is a small suburban town with 2,660 people in 1966,

lying only two miles southeast of the city of Vernon, which had a population of 11,423 in the same year (D.B.S. Census figures). It is 323 highway miles from Vancouver and 345 miles from Calgary. Within its 100-mile radius is a trading area with a population of 150,000 ("The Okanagan", Trade and Commerce Magazine, B.C., 1966). An important market centre in this area is Kelowna which, in 1968, consumed 4,200 tons of the glass containers manufactured in Burnaby. Besides this, Coldstream is 195 and 31 miles closer to Trail and Creston respectively than Redcliff is to these communities. Hence it stands to gain from its proximity to the 9,000-ton-a-year market area of Warfield, Trail and Creston which the plant in Redcliff serves. Edmonton, on the other hand, is 130 miles beyond the tentative 400-mile economic limit. But it is not unlikely that the Consumers Glass Company may attempt to enter the Edmonton market. If a favourable freight rate is negotiated, this may be possible since the Dominion Glass Company still ships containers from Redcliff to Winnipeg, a distance of 653 miles.

This analysis of the potential market areas for the Coldstream plant shows that the Coldstream site is an intermediate location between the British Columbia and Alberta market centres (Fig. 7). It is possible that is was this attribute of the site that attracted the plant. Yet the question of distance is not the only factor which influences the choice of sites. Some other factors were also evaluated before the company decided on Coldstream. According to Mingay, the site has adequate water supply, power, and a soil base strong enough to carry the silos and furnaces, and is close to rail and road transportation facilities (Vancouver Province, August, 1968). Apart from these, the Coldstream site is considered to have two additional advantages:

GLASS CONTAINER MARKET CENTRES IN BRITISH COLUMBIA AND ALBERTA

Figure 7

"The Okanagan Valley qualifies under the federal government's development incentive program, a saving to the company of approximately $3,000,000; and the areas's labour force is stronger than Alberta's" (Calgary Herald, August, 1968).

Compared with the factors which were found likely to have explained the choice of the Redcliff and Burnaby sites, the Coldstream situation is quite different. The site was chosen not only because of the advantages to be derived from locating in a Designated Area, but also because the company needs a location which will help it break into the Western Canada market which, for over half a century, has been served by the Dominion Glass Company and imports from foreign countries. The conclusion to be drawn is that the choice of sites for the three glass-container manufacturing plants in Western Canada may be explained by different factors. Industrial inertia may account for the Redcliff site today, market-orientation and municipal tax structure for the Burnaby plant, while the Coldstream site has been chosen partly because of its central location between the market areas in the two provinces, and partly because of the economic advantages offered by the federal government's Industrial Development Incentives Act.

The location of the Consumers Glass Company's plant in Western Canada will inevitably produce changes in the distribution and share of the glass-container market from what exists today. Although it is very difficult, if not impossible, to say what the company will do as regards the markets, it is obvious that the first attempts will be to break into some portions of the existing market in British Columbia and Alberta. To this end, "The company intends to add new warehouses, tentatively planned for Vancouver and an Alberta community." (Financial Post, August, 1968). Certainly this will induce some changes in the marketing policy of the Dominion Glass Company in the west. The

result will be a change in the distribution and importance of the market areas as they stand today (Figures 5 and 6).

In this thesis, we have attempted to study the geography of the glass-container industry in Western Canada. The brief survey of the historical background reflected the economic conditions and the level of technology during the nineteenth century when the industry started in the east until it reached the west. It revealed also the drive with which the pioneers set the stage. But more important, we found how, from very small beginnings and economic difficulties, a completely Canadian-owned industry developed. From this background, we then analyzed the nature and scale of operations and the structure of production costs. It was found that the industry has passed through a technological revolution. Before the turn of the century, glass containers were moulded by manual operations. Glass-blowers were in great demand, and consequently were highly paid for the times - five dollars a day. Today, however, the whole manufacturing process is automated. Yet, as in the early days, the industry is still labour-intensive, though in a different sense. Inspection and packing alone account for no less than half the number of people employed, and there has been more than a 400-per-cent increase in average wage rates since the first decade of the century.

The changes which the industry has passed through are not only economic but also geographical. Unlike the early factories which were local in outlook, the space relations of today's plants reach afar. Raw materials come from sources several hundred miles away, and the finished products from the Redcliff plant are distributed in all the four provinces of Western Canada. It was learned that the amount of

glass containers shipped to Saskatchewan and Manitoba decreases with increasing distance from the Redcliff plant. However, it was also found that there is a weak relationship between the size of the cities (in terms of population) and the tonnage of glass containers these cities receive from the plant.

The examination of the possible reasons for the location of the plants in Redcliff, Burnaby, and Coldstream showed that there were different factors involved in the initial establishment of each of these plants. In the past, the industry was oriented to local markets. At present, however, the industry may be considered as being market-oriented in a broader regional context. A plant may be situated at a site which comprises the largest single city market of all the communities served, for example, the Burnaby plant . On the other hand, a plant may be located at an intermediate site among the various city markets to be served, for example, the Coldstream plant.

Finally, the brief look at the challenge to glass containers from other containers shows that there is a relatively fast growth rate of 5.5 per cent per year for the future of the glass-container industry in Western Canada. This potential growth and the location of the Consumers Glass Company's plant in Coldstream will effect a change in the nature, structure, and distribution of the market among the three plants, and should be an interesting field to investigate a few years from now.

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APPENDIX

PAST AND PRESENT GLASS-CONTAINER MANUFACTURING ESTABLISHMENTS IN CANADA

1825-1839/40	The Mallorytown Glass Works, Mallorytown, Ontario.
1847- ?	The Ottawa Glass Works, Como, Quebec.
1855-1875	The Forster Brothers Glass Works, St. Johns, Quebec.
1865-1875	The Canada Glass Company, Hudson, Quebec.
1865-1895	The Hamilton Glass Works, Hamilton, Ontario.
1867-1875	The St. Lawrence Glass Company, Montreal, Quebec.
1874-1878	The New Brunswick Crystal Glass Company, New Brunswick.
1875-1878	The St. Johns Glass Company, St. Johns, Quebec.
1875-1909	The Burlington Glass Works, Hamilton, Ontario.
1878-1880	The Excelsoir Glass Company, St. John, Quebec.
1880-1883	The Excelsoir Glass Company, Montreal, Quebec.
1881-1883	The Napanee Glass Works, Nepanee, Ontario
1881-1892	The Nova Scotia (Diamond) Glass Company, Trenton, Nova Scotia.
1883-1890	The North American Glass Company, Montreal, Quebec.
1886-1898	The (Early) Dominion Glass Company, Montreal, Quebec.
1890-1902	The Diamond Glass Company Limited, Montreal and Elsewhere, Quebec.
1890-1902	The Lamont (Diamond) Glass Company, Trenton, Nova Scotia.
1890-1914	The Humphrey Glass Works, Trenton, Nova Scotia.
1893-1893	The Erie Glass Company, Port Colborne, Ontario.
1894-1900	The Toronto Glass Company, Toronto, Ontario.

1895-	The Syndenham (Diamond) Glass Company, Wallaceburgh, Ontario.
1895-1899	The Forster Glass Works, Port Colborne, Ontario.
1899-1902	The Ontario Glass Company, Kingsville, Ontario.
1903-1913	The Diamond Flint Glass Company, Limited, Montreal, Quebec.
1907-1914	The Manitoba Glass Manufacturing Company, Beausejour, Manitoba.
1907-1908	The Crystal Glass Company, New Westminster, British Columbia.
1913-1918	The Diamond Glass Company Limited, Beausejour, Manitoba.
1913-	The Dominion Glass Company Limited, Redcliff, Alberta.
1913-	The Dominion Glass Company Limited, Montreal and Elsewhere, Quebec.
1913-	The Consumers Glass Company, Limited, Montreal, Quebec.
1913-	The Consumers Glass Company, Limited, Toronto, Ontario.
1913-1925	The Jefferson (Diamond) Glass Company, Toronto, Ontario.
1914?	The Victoria Glass and Bottle Company, Limited, Vancouver, British Columbia.
1915-1920	The Humphrey's Glass Works, Moncton, New Brunswick.
1924-1925	The Demarais and Robitaille Limited Glass Company, Montreal, Quebec.
1964-	The Dominion Glass Company, Burnaby, British Columbia.
1969?-	The Consumers Glass Company, Coldstream, British Columbia.

SURVEY QUESTIONNAIRE

Date_____

1. Name of Firm_____

2. Address of Firm_____

3. When was your factory built?_____

4. Did it start as a branch plant?_____YES _____NO

5. If the answer to question 4 is YES, then

   (a) Name of parent firm_____

   (b) Where is parent firm located?_____

   _____

PRODUCTION

6. Please list, in order of their current importance, the different types of glass containers which your plant manufactures.

   (a)_____

   (b)_____

   (c)_____

   (d)_____

   (e)_____

   (f)_____

7. At what total tonnage per year are your unit costs of production the lowest? _____

RAW MATERIALS

8. The main raw materials are:

Raw Material	Tons Used Per Year
(a)	
(b)	
(c)	
(d)	
(e)	
(f)	

9. The sources of the above raw materials are:

Raw Material	Province and Area	Area in the U.S.	Other Countries	Means of Transportation
(a)				
(b)				
(c)				
(d)				
(e)				
(f)				

10. The average freight rates on the raw material per ton mile are:

Raw Material	Freight Rate per Ton Mile
(a)	
(b)	
(c)	
(d)	
(e)	
(f)	

FUEL

11. What is the most suitable fuel for glass manufacture?_____

12. Which fuel does your plant use?_____

13. Where is the source of your fuel supply?_____

14. What proportion does fuel cost form of total production costs?

_____

LABOUR

15. The composition of the labour force is:

skilled workers_____%

semi-skilled workers_____%

unskilled workers_____%

16. The lowest hourly wage at present is $_____

The highest hourly wage at present is $_____

The average hourly wage at present is $

17. From 19___ to 19___, wages have increased from $_____to $_____.

18. The number of people employed at present is: M F

____ _____

19. The number of people employed and labour costs as a percentage of total production costs are:

Year	Number of People Employed	Labour Costs: % of Total Production Costs

Year	Number of People Employed	Labour Costs: % of Total Production Costs

MARKETING

20. The main customers served, and the percentage of total output purchased by each are:

Customer	Location of Customer	% Purchased
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		
(g)		
(h)		

cont'd ....

Customer	Location of Customer	% Purchased

21. The means of transporting finished containers to customers:

(a) railroad carries_____%

(b) truck carries_____%

22. The average freight rate per ton mile on glass containers shipped to customers is $_____.

23. Do you expect an increase in the market potential of

(a) the province you are located in?_____YES _____NO

(b) your general market area?_____YES _____NO

(c) the market in Western Canada?_____YES _____NO

(d) the countries you export to (if you export)?_____YES _____NO

LOCATION FACTORS

24. When comparing your present location to other cities in Canada,

would you say that there are any notable factors which make this area an advantageous location for your plant? If YES, please mention:

_____

_____

_____

_____

Are there any notable factors which make this area a disadvantageous location for your plant?_____

_____

_____

_____

25. Is your company considering opening a new plant? If YES, where and why? _____

_____

_____

_____

26. Is your company considering moving to a new area? If YES, where and why? _____

_____

_____

_____

27. Is your company considering expanding present plant facilities?

_____ YES _____NO

28. The following consists of a number of factors which, other studies have shown, indluence the location of manufacturing plants in varying

degrees. Please check 1, 2, 3, etc. under each heading, the importance of each factor as reflected in the location of your plant:

Demand

( ) access to markets

( ) anticipated growth of markets

Labour

( ) prevailing wage rate

( ) labour relations

( ) productivity of the workers

( ) availability of skilled workers

( ) avialability of labour

Raw Materials, Fuel and Energy

( ) availability of raw materials

( ) transportation facilities

( ) freight rates

( ) water supply

( ) power supply

Community

( ) community facilities - educational, recreational

( ) community attitudes towards new industry

( ) plant sites or available building

( ) municipal tax structure

Personal Factors

( ) personal (wish economic advantages, e.g., friendship with customers, suppliers, or bankers)

( ) personal (without economic advantages)

cont'd ....

Miscellaneous

( ) waste disposal

( ) availability of local financing

Others (please specify) _____

_____

_____

_____

THE FUTURE

29. What industries do you expect to be the greatest consumers of glass containers?

(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

(f) _____

30. What effect do you expect competition from cans and plastic containers to have on the glass-container industry? _____

_____

_____

_____

31. What effect on production do you expect one-way bottles to have on the glass-container industry? _____

_____

_____

_____